AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 15, NO. 20. WEEKLY. | NEW YORK, THURSDAY, MAY 19, 1892. | $3.00 per Annum. SINGLE COPIES 6 CENTS.

COPYRIGHT 1892, BY AMERICAN MACHINIST PUBLISHING COMPANY.

For Sale Everywhere by Newsdealers.

ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

Die Slotter.

We illustrate on this page and on page 2 a die slotter made by the Garvin Machine Co., New York.

The machine appears to combine the special features desired in a tool of this kind. The two cross motions and the rotary table provide for following any outline, and the arrangement of handles is convenient and avoids mistaking one for the other. The handle for the rotary table has provision for using dials for dividing purposes, which is convenient for such work as that shown in Fig. 3 (page 2). For the small numbers of divisions and for rapid work the worm shaft can be pulled out, and a lock-pin arrangement used for indexing the table, the handle for which is shown at the left-hand side. The handle for raising and lowering the knee is conveniently placed on the side of the knee (not shown in the cut).

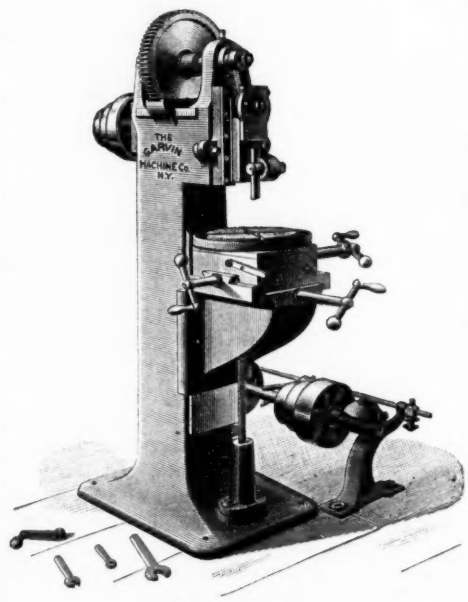
The stroke of the machine has been fixed at 2½", which is amply sufficient for the class of work intended, and affords a more solid arrangement than an adjustable pin.

The work can be brought into proper relation to the stroke by raising the knee, and for thin work, since the cutting is done at the last or slowest part of the stroke, the number of strokes can be increased by means of the cone pulley, which thus compensates for any surplus stroke.

To give the required draft to the die, the slide for the ram can be swiveled either way and set by the graduated index; with this arrangement the draft is the same in every part of the die.

The tool block is well adapted to hold special tools, such as the one shown in Fig. 1, plugs which bear on a cam, which is bushed into the lower end of the connecting rod, and derives a partial rotary movement from the action of the rod, and by this motion locks the tool block.

As an instance of what can be done on the machine we are informed that a type writer key of form shown in Fig. 2, 10" long and $\frac{3}{16}$" wide at narrowest part, was machine-finished in six hours, and a die for armature rings 5" diameter with 36 notches $\frac{1}{8}$" wide, $\frac{1}{4}$" deep, such as shown in Fig. 3, in two hours.



DIE SLOTTER.

We recently had a call from Nicholai Holm, foreman metal pattern maker for Marstrand, Holweg & Co., Copenhagen. Mr. Holm is making a considerable tour of this country, in the interest of the firm. He says American machinery is considerably used in that part of the world, and is well liked.

New Pipe Threading and Cutting Machine.

The engravings represent a pipe cutting and threading machine of new design, to be driven either by belt power or by hand. Simplicity of construction has been especially sought in this machine, and there are as few removable parts as the work will admit of. The pipe does not move endwise during the threading operation, but is revolved while the carriage carrying the dies is moved onto it.

The power machine has the cone pulley at right angles to the ways, and though there are but two steps on the cone, four different speeds are secured by attaching the cone pulley and pinion to the shaft by a slip bolt.

The hand machine is so arranged that the relative speeds of the crank and the large gear driving the spindle may readily be changed, thus giving to the operator whatever advantage of gearing may be necessary for the size of pipe being cut or threaded. This is done simply by changing the crank from one shaft to another, three such changes being provided for. Two cranks may also be used at the same time, one on each side, thus enabling two men to work at the machine, though the arrangement is such as to enable one man to thread or cut 4" pipe.

The cutting-off head is arranged with a tool slide and self-centering V-jaws to steady the pipe while being cut off. It is also arranged to use adjustable expanding, or solid dies. The carriage with cutting off head and die is moved by rack and pinion, worked by a hand-wheel. The gripping chuck for holding the pipe is of the standard universal type.

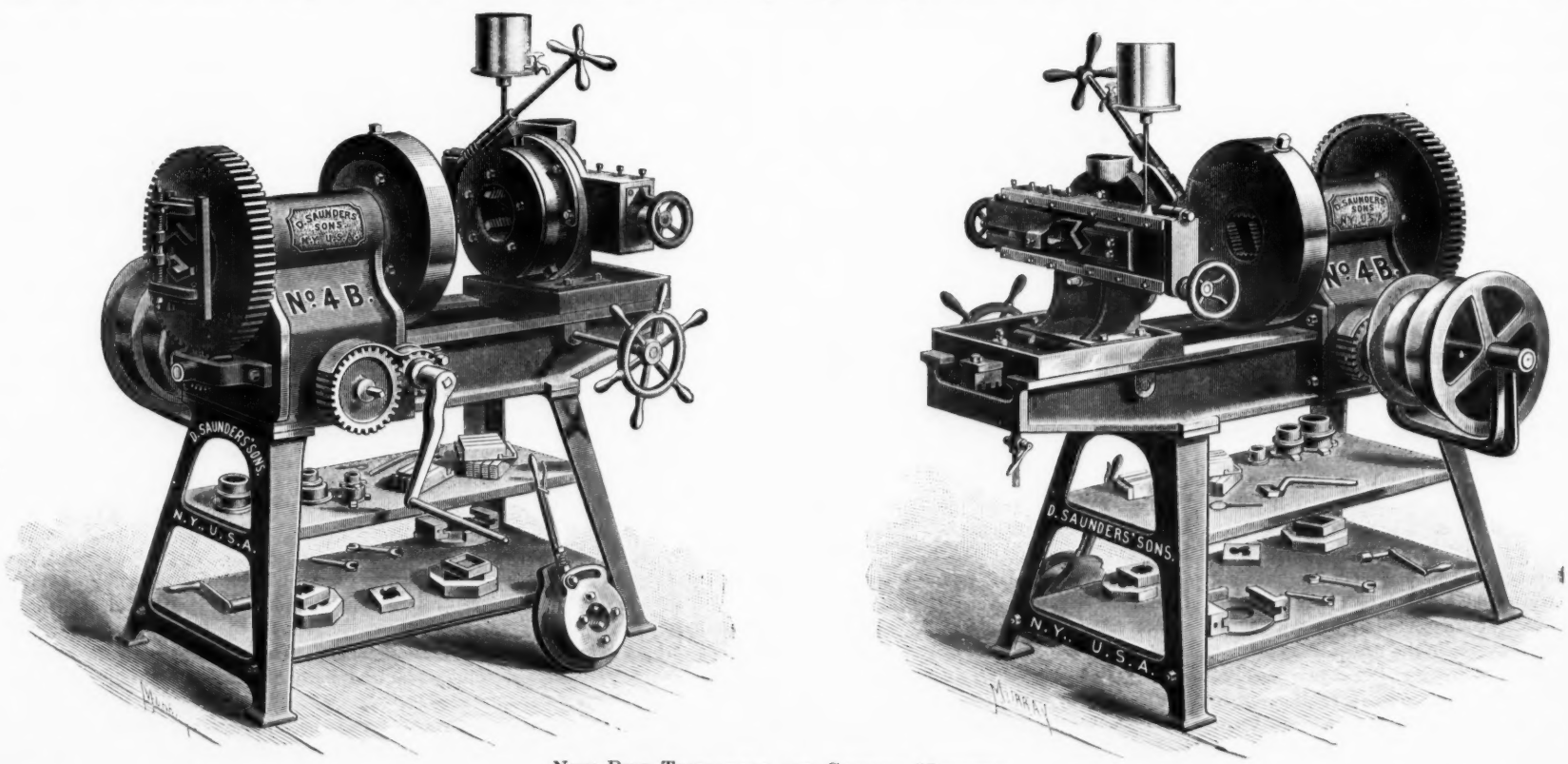
At the rear end of the spindle, on the face of the large driving gear, is a two-jawed self centering chuck to center the pipe, doing away with bushings or guides.

The die shown in place on the machine is adjustable by the movement of a ring, in which there are cam slots that operate to open and close the chasers for 2½" to 4" pipe by a worm 2" and smaller sizes, by a lever, as shown.

The machine is quite complete in all its details, and is adapted to a very large range of work. Capacity ¼" to 4".

It may be arranged to work by power only, by hand only, or by both hand and power, as may be preferred.

The makers are D. Saunders' Sons, Yonkers, N. Y.



NEW PIPE THREADING AND CUTTING MACHINE.

The Buzz Planer.

BY JOHN M. RICHARDSON.

As the buzz planer is such a useful tool for pattern makers, and being so much used, and frequently, I am sorry to say, so much abused, it seems that perhaps something said in its behalf may not be amiss. To produce the most satisfactory results from this valuable tool, many small points must be considered; for, as the old Scotch proverb has it, "Many mickles make a muckle." To begin with, it should stand on as firm a place as can be given it; for, as it runs at such a high rate of speed, if it does not stand securely there will be a very perceptible jar or vibration. In my opinion, common belt lacings should not be used on the driving belt; instead, either have it cemented or else use a metallic lacing which clinches on the under side and leaves the joint perfectly smooth. This is better, for the reason that, owing to the high rate of speed and the small diameter of the pulley on the knife arbor, a common lacing will pound more or less every time it passes

over the small pulley, because of the unavoidable bunch it makes on the inner side of the belt.

After the machine is secured in position and belted it is a good plan to test it and see if the tables are in line; for if they are not, then no amount of adjusting the back table to the height of the cutters will make it possible to plane two long strips perfectly straight, so that when they are laid together they will not show an opening either at both ends or in the middle. One method of testing the tables is as follows: Place a long steel straight-edge so that half of it rests on the back table, then raise the front table till it meets it, and the straight-edge seems to have an even bearing on both. Next, place a strip of paper under each end, and others at intervals between; try the papers and see if any draw out easier than the others. If possible, adjust the tables so that all seem to draw alike. If they do, it is safe to say that the tables are in good condition with regard to being in line. If, after a careful trial, the straight-edge does not bear on the strips near the throat of the planer, or, on the other hand, if it bears upon them and not upon those at its extremities, then in either case it is plain that the end of the table where there is no contact is too low, and must be raised slightly by loosening the bolts underneath it, and building up with pieces of paper until the straight-edge has an even bearing upon all the pieces at the same time.

I would not recommend a speed of less than four thousand revolutions per minute, nor more than five thousand. If the machine runs too slow the result will be that the work will not be smooth, even if the knives are sharp.

In the opening paragraph I spoke of the buzz planer frequently being a much abused tool. Now it may be interesting to some to know what the worst case of the abuse of this tool was which has ever come to my notice. It was a 16″ planer in a shop where I once worked for a short time, and the edge of the back table had actually been filed off on an easy bevel, so that when a board passed over the knives it could "ride up over it" without striking. Some ignoramus had evidently tried to plane a piece, and found the back table set a trifle higher than the cutters, and, not having brains enough to remedy the evil by lowering it, he had resorted to the filing process. It reminds me forcibly of what my grandfather used to say about the fools not all being dead yet.

In another place where I was employed, the planer used to go week in and week out without being sharpened, till a board, after it had gone over it, would remind one of a piece of plowed ground, and then there was all the labor of treating it the second time with the hand-plane.

Does this practice pay? I most emphatically claim that it does not; for I have seen too many hours wasted by using a hand-plane, simply because the foreman would not take the time to keep the buzz planer in good order. But the time lost by the men in sharpening their own planes, besides continually using them on machine-planed work, did not seem to occur to him. It will be necessary to use a hand-plane but comparatively little in a pattern shop where there is a good buzz planer, and never in getting out stock to glue up, unless it is very small indeed. A planer is always so dull that it needs to be sharpened when it becomes necessary to go over the work afterward with a jointer on the bench.

Quite a novel method of sharpening the knives has recently come to my notice, and while I do not claim the principle as original with myself, still I consider it so good that I will explain it. It applies to the cutters when there are no very bad nicks in them; in other words, when they are not in quite bad enough shape to be removed and concaved on a knife grinder. Take a thick board planed perfectly true about 18″ long and 6″ wide, as shown in Fig. 1, and glue a strip of hard wood ¼″ thick, and an inch or so in width across each end. On the same side of the board glue a sheet of emery cloth (No. 60 or finer), taking great care to get it on even, with no bunches or blisters under it. To use this, first turn the knife arbor so that the bevel on the blade is in just the right position, and if it turns very easily tighten one of the screws a little on one of the boxes. Next lower the tables alike, so that they will stand in line ⅛″ lower than the top of the cutters. Cover the emery cloth with oil, and place the board over the blade. Adjust the table so that the emery cloth takes hold a little. Now fit a little block of wood snugly between

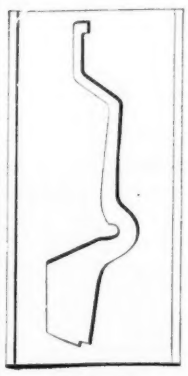


Fig. 2.

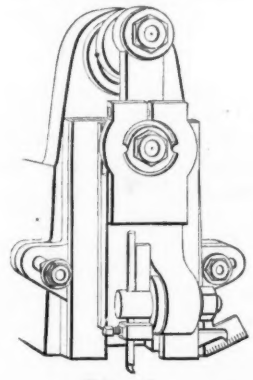


Fig. 1.

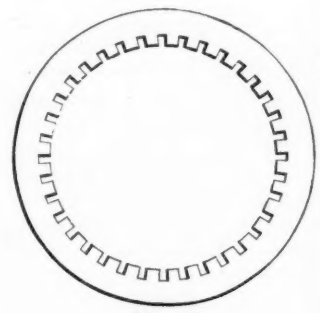


Fig. 3.

DIE SLOTTER.—SEE PAGE 1.

the edge of the knife and the middle of the edge of the front table. Take it out and save it for a stop for the second cutter to rest against when it is brought into position. This will insure the two knives being in the exact relative position. Now work the board back and forth till it has ceased to cut in turn on both knives. Nothing but the two strips of hard wood on the ends of the board can possibly touch the tables, and there is no danger of any emery working into the bearings. Wipe off the emery, and oil with a piece of waste, and return the tables to their normal position. Finish with the oil stone as usual. The edges of both knives will now be perfectly straight their entire lengths, and exactly parallel to the tables. This is the great feature of this method.

A good test for the work is to plane two short pieces of board, taking a light chip, and then place them firmly together, and lift them both by means of the upper one alone. Of course the under one will only stick for an instant, but they ought to be good enough surface plates, so that one will lift the other.

It is a rather risky matter to hold stuff ½″ thick or less with the hands, and I have found a shoe or holder like the one shown

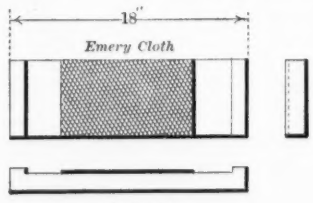


Fig. 1.

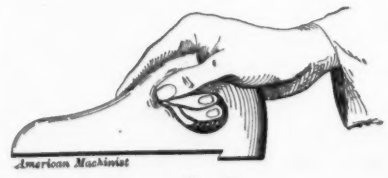


Fig. 2.

BUZZ PLANER.—SEE PAGE 1.

in Fig. 2 to be very useful on all short stock of most any thickness. Cutting places in it for all the fingers to rest in makes it feel good to the grasp, and at the same time the hand is safe. A description of this is unnecessary.

Machine Guns.

In a letter to London *Engineering* Hiram S. Maxim says:

The effect of very rapid firing upon the chamber and rifling of the gun is most marked. In Austria, when a gun was fired at the rate of about 600 per minute with steel-covered bullets, and the fire was often stopped to replace the ammunition boxes, it was found that the gun made as good a target after 20,000 rounds had been fired as it did upon starting, while with a speed of 670 per minute, with practically no stoppages, the bore was considerably injured after 10,000 rounds had been fired. During all of the Austrian trials with the Maxim gun 200,000 rounds of ammunition were used, the greatest number fired at one time from a single gun being 35,000.

As regards the speed that it might be possible to attain with a single-barreled gun, I would say that probably if both the gun and cartridge were made expressly for producing the highest possible rate of fire, and if the recoil energy, together with the escaping force of the gases, were both utilized, 1,500 to 1,600 rounds a minute might be fired; but at this speed the barrel would be very highly heated, even if inclosed in a water casing.

Machine guns which are operated by hand are, as a rule, provided with more than one barrel, and perhaps the greatest absolute speed that ever has been attained was with a twelve-barrel Nordenfelt gun, in which each barrel was fired 100 rounds per minute; but this feat can only be accomplished by a very powerful and trained athlete. The Gatling ten-barrel gun did not, I believe, fire over 400 rounds a minute at the Shoeburyness trials, but it is said now to fire at the rate of 100 rounds per barrel per minute.

The greatest speed ever attained by a single-barrel hand-operated machine gun was when Gardner himself fired 250 rounds per minute. The Nordenfelt five-barrel gun, such as is used in the British navy, may be fired with three trained operators about 400 to 500 rounds per minute. At the Swiss trials the two-barrel Gardner gun, with four men to operate it, fired 333 rounds in a minute.

On Compounding Centrifugal and Load Governing by a Rotary-piston Valve.

BY WM. S. ALDRICH, BALTIMORE, MD.

(A Paper presented at the San Francisco Meeting of the Mechanical Engineers)

The matter of governing steam engines for uniform speed, and economy in the use of steam, becomes more difficult as the size of engine is increased. Especially exacting are these requirements in the electrical service, whether for light, power or railway work, with the extended use of marine engines of the vertical-inverted multiple-expansion type. These are directly coupled (or, at most, directly belted) to large multipolar dynamos—two or more for each engine unit. The rotative speeds are consequently much higher than in the same type of engines at sea, and the boiler pressures are also greater. For the concentration of great engine power, in a limited space, becomes a serious question in the construction of large municipal electrical supply plants, in or near the center of the area of distribution. This, with the demand for economy, has led to the adoption of the marine engine in central station work.

The inherent difficulties of governing steam engines cannot be overcome. The only control of the steam supply is during admission, whether by controlling the pressure or the point of cut-off, or both. The variable driving effort on the piston, due to expansive working, the variable effect of the inertia of the reciprocating parts, and the variable crank efforts, can only be more or less met by the steadying action of a well-designed fly-wheel.

The nature of the problem presented—in view, especially, of marine engines in central stations—may be outlined as follows:

(1) The speed regulation to be as nearly perfect as the operation of the governing forces and of the regulating mechanism will permit.

(2) The steam supply to be as directly proportioned to the external load as the mechanism of the steam engine will allow, by varying the mean effective pressure on the piston.

(3) Automatic regulation of the point of cut-off alone, or of all the events of the steam stroke, if desired.

(4) The valve, valve mechanism and governor mechanism to be as free as possible of any needless frictional resistance, requiring a minimum power to alter their motions in sense, direction or magnitude.

(5) The governing forces to be brought into operation upon any change of speed or of external load, or of both at the same time, by compounding the centrifugal and the load governing principles.

(6) The centrifugal governing forces to operate on the valve mechanism at a minimum required variation of speed.

(7) The load, or dynamometric governing forces, to be indirectly applied, and not through the intervention of mechanism by and through which the power is transmitted from the engine to the dynamo.

(8) The instantaneous variations of the external load to be as immediately and positively felt at the valve as the load governing mechanism will permit.

(9) The variations, through any cause, of the driving effort on the piston and internal friction of the engine, as distinct from the external load variations, to be controlled by effective and sensitive centrifugal governing.

(10) The compounding of the centrifugal and the load governing forces to be effected in such a way that they shall operate upon the valve independently of each other, or more or less dependently.

In discussing Mr. F. H. Ball's paper before this society on the new principle in steam engine governing, Mr. W. C. Kerr* states the primary requirements of an engine governor to be: (1) A reasonably small variation in speed, light or loaded; (2) a very small acceleration for an instant, following a change of load; and, where the most delicate regulation is required, this instantaneous acceleration is of much greater consequence than the difference in revolutions between light and loaded conditions.

A compound automatic cut-off valve mechanism, operated by centrifugal and load governing forces, presents a somewhat satisfactory solution of almost all of these questions. Consider the case of a single valve for a single cylinder engine. The two governing forces may be introduced by making the valve of the piston type, and giving it a variable movement of reciprocation, with a variable movement of rotation or of oscillation, the movements being independent of each other. The valve friction will be reduced to a minimum by combining reciprocation with rotation. The centrifugal governing forces control the variable reciprocation; the load governing forces, the variable rotary movement, or *vice versa*. An electro-magnetic mechanism under control of the turning moment of the dynamo, or of its external electrical circuit, introduces the load, or dynamometric principle. This electro-magnetic control of the point of cut-off not only possesses great facility of application, but differs from all other applications of the dynamometric principle in not requiring intermediate transmissive mechanism, with gear wheel or pulley trains, nor weights, springs, or belt tension devices of ordinary transmission dynamometers. It also acts instantaneously upon any change of load on the dynamo

* Transactions of the American Society of Mechanical Engineers, Vol. IX., 1887–88, pp. 315, 316.

circuit; and it is not possible to anticipate further any load changes, because the slightest change of load is instantly felt at the valve, through the electro-magnetic mechanism controlling one of its movements.

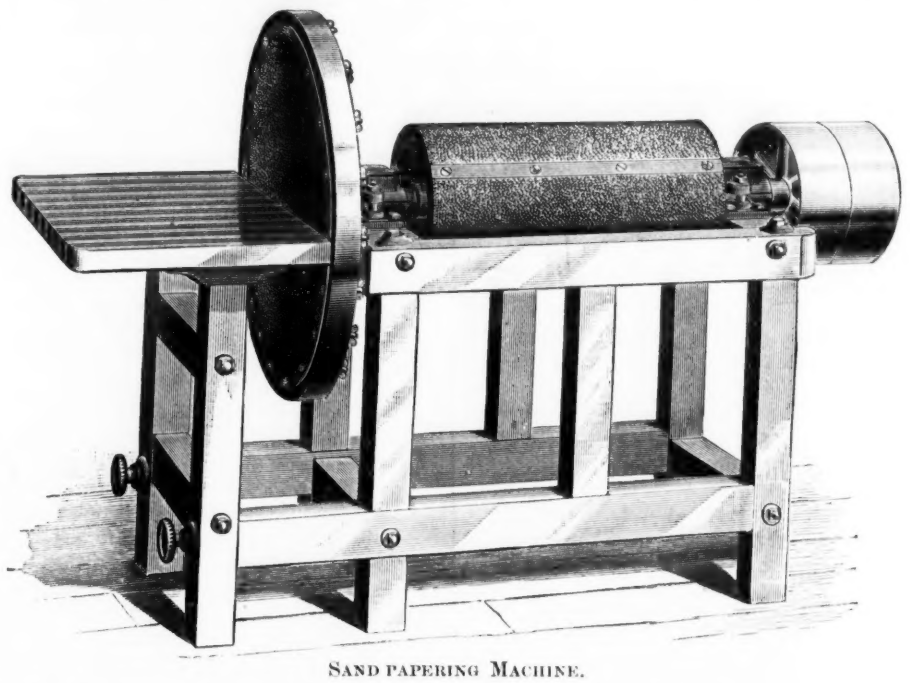
An analysis of some of the combinations more or less desirable, as to the steam supply, gives to the reciprocating movement the main control, and to the rotary movement the auxiliary or independent cut-off, or *vice versa*. Both rotary and reciprocating movements may be operated independently or in conjunction with each other. In a single rotary piston valve all the points of the steam stroke are under control. Arranged for the Corliss type, the rotary-piston valves would be used at each end of the cylinder to control the admission and cut-off, while release and compression are fixed for the best normal working conditions. In multiple-expansion engines, each cylinder is fitted with a rotary-piston valve; though, in some cases, load governing forces may alone be used to control the steam supply for the low-pressure cylinder.

The valve of the piston type, placed vertically in the vertical-inverted marine engines at the central station, reduces valve friction to a minimum, when it is rotated and reciprocated, each to a continuously varying extent. Variable steam admission and cut-off is effected by helical or other curved ports in the piston valve and its seat. The two elements of the helical port may be designed independently or otherwise, according to the conditions under which the valve is to operate. The valve wil thus have large port opening when most needed, and quick cutting-off qualities.

A compound movement of the stem of the rotary-piston valve may be accomplished, for instance, by giving the centrifugal shaft governor control of the reciprocation; and the electro magnetic mechanism control of the rotary movement, by and through a turning sleeve (as a guide block) fitted over a squared portion of the reciprocating valve stem. Many other simple devices, to get this compound variable helical motion of the valve, will suggest themselves as circumstances arise.

The mechanism for both variable reciprocation and rotation may be any one of the many well-known forms; such as the pendulum and the compound eccentric, for reciprocation; and quick-return motion mechanism of the Whitworth or other types, for rotation. Or mechanical combinations may be replaced by their kinematical equivalents in the form of electro-magnetic mechanisms. The peculiar advantage of the latter in this case is, that the variable electro magnetic forces, under control of the dynamo load, may be applied directly to the valve stem at the most convenient point, and without any reducing or other intermediate mechanism of a mechanical nature. This will also reduce the friction in the governing mechanism.

The electro-magnetic mechanism employed to control the valve movement, more or less in proportion to the external load, may be of several typical forms, utilizing different principles in the operation of electro-magnetic machinery.* The solenoid mechanism, for reciprocating rectilinear or curvilinear movement, having its coils connected in electrical circuit with the dynamo, and its iron core plunger connected to the valve mechanism; the armature mechanism, for partial or complete rotatory movement, whose small shaft is the valve stem, which is thus brought under electrical control of the dynamo current; and an armature mechanism utilizing a proportional part of the turning moment (torque) of the main dynamo which is directly coupled to the engine (or may be otherwise driven)—these are some of the combinations desirable. In fact, these are sliding or turning pairs, under direct electro-magnetic control of the dynamo current, which may be used with the complementary movement from the centrifugal governor mechanism to produce the resultant variable helical movement of the rotary-piston valve, and so control the steam supply.



SAND PAPERING MACHINE.

The fundamental principle of a rotary-piston valve makes it possible to apply it to other cases than that here considered especially. It admits of controlling the point of cut off by hand, as in the Stephenson and other link motions, with reversibility, so adapting it to the locomotive and marine service, where no special uniformity of speed is called for. The reciprocations may be made by a fixed eccentric, as in the "Trenton" steam engine of the Phœnix Iron Company; and here the partial rotation is controlled by the tripping mechanism and dash-pot accompaniment of a fly-ball governor like the Corliss type. A hand-wheel on the valve stem, or connected by suitable mechanism, would give absolute control of the steam supply and point of cut-off in locomotive and marine engines, whose eccentrics are fixed (of constant eccentricity).

On the other hand, the rotary movement may be made the chief element of the valve motion, and the reciprocation controlled by hand, by an auxiliary device. One rotary-piston valve may thus perform all the functions of an independent cut off, as in the Buckeye and Meyer types, whether reciprocation or rotation be the chief element of its motion. In the latter, too, the rotary movement may be a partial or complete rotation, and either of these uniform or variable.

The rotary-piston valve, with its variable compound helical motion, possesses all the advantages of a slide valve and a piston valve, and the inherent disadvantages of neither. There is no scoring or grooving of the valve face or its seat; hence minimum liability to leakage and a maximum duration of normal working conditions. The structural advantages of piston valves are all maintained. By giving a rotary motion to a piston valve, or a sliding motion to a rotary valve, as is here done, the governing forces are a minimum to effect any change in either motion of the valve; for the angular movement is more easily varied than it would be with no sliding, and the travel of the valve is more easily changed than with no rotation. These features make it very easy to control one or the other movements by hand (in locomotive and marine engines), or by sensitive governing mechanism for central station engines; and in the latter case this becomes a marked advantage, as it allows of dynamometric governing by delicate adjustments of the electro-magnetic mechanism to suit the external load conditions.

The advantages of governing central station and other engines in the electrical service, by compounding the centrifugal and the load governing forces by a rotary-piston valve, may be thus summed up:

(1) Best combination of conditions for uniform speed under no load or extreme variations of load, and steam pressure constant or slightly variable.

(2) Steam supply as directly and instantaneously proportioned to the external load as it is possible to make it by electro-magnetically controlling the point of cut-off.

(3) Valve friction reduced to a minimum.

(4) Load governing forces capable of the most sensitive and delicate adjustment by electrical means.

(5) Independent governing against variations in the external load, compared with variations of driving effort and of the internal load of the engine.

(6) Each governing principle regulates that which the other cannot, and without interference.

(7) Rotary-piston valve, with helical ports, gives quick and sharp cut-off, with increased port area.

(8) Failure of either governing device permits of the engine running temporarily under control of the other.

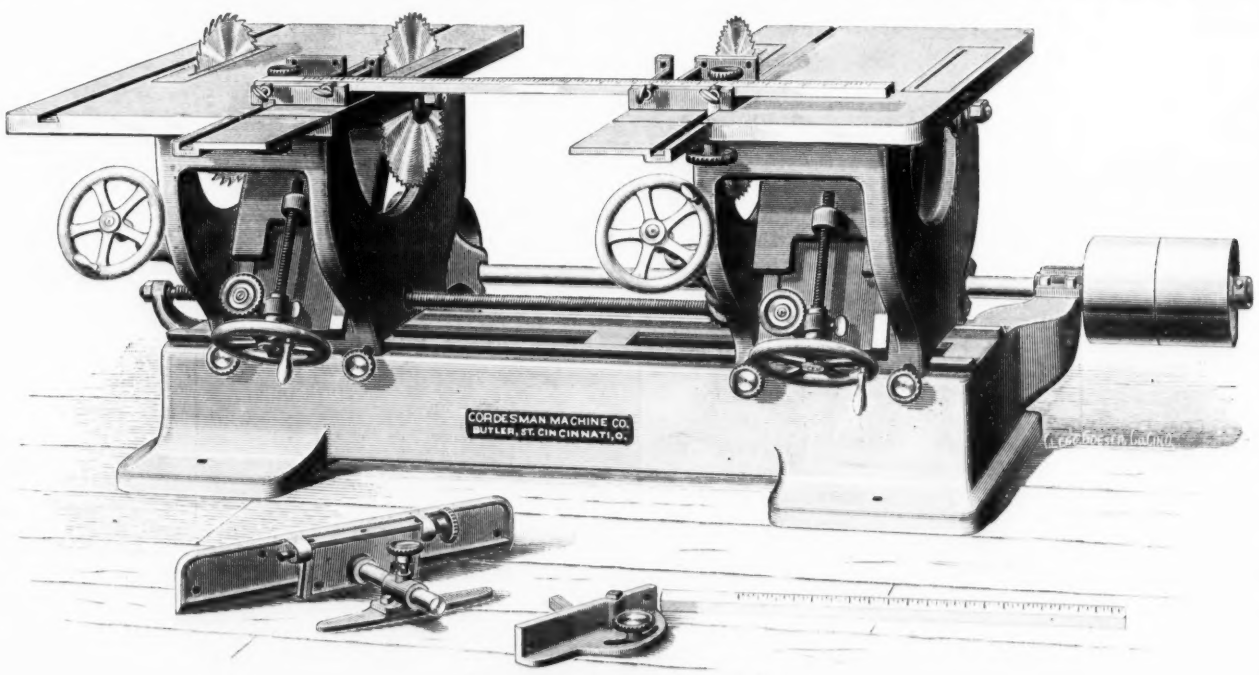
(9) Dynamometric governing of a multiple-expansion engine driving several dynamos, any one of which may be thrown on or off at any time.

* See Notes on Electro-Magnetic Machinery, *Journal of the Franklin Institute*, February and March, 1892.

Improved Double Cut-off Saw—Sand-papering Machine.

One of the illustrations herewith represents a cut off saw in which the heads, each carrying an arbor upon which two saws can be run, are adjustable along the bed independently of each other by means of the hand-wheels seen at the left of each head. This arrangement gives an advantage, especially where two men are working at the machine, because either can adjust his head to suit his work without disturbing the other.

The saws run upon large steel arbors, their nominal distance apart being 18″, although by a recent improvement they may be set 20″ apart, thus permitting the sawing of stuff from 18″ to 20″ on each head. The tables do not adjust for height, but instead the saws are raised or lowered to project any desired distance through the tables, this being accomplished by means of a sliding head which moves upon an incline by means of the inclined screws seen in front. Thus the tables are kept always at the same height, which is found to be very convenient for the workman.



IMPROVED DOUBLE CUT-OFF SAW.

There is a special device for maintaining the tension of the belts, which is operated by a simple hand-wheel and screw, and pulls forward the swinging frame to give any desired tension. This, being accomplished without the use of idlers, or, in fact, of any additional pulleys, conduces to simplicity and economy of operation. The counter-shaft bearings are cast with the base and the machine is entirely self-contained.

The mandrel boxes are self-oiling and are also adjustable, so that the saws can always be given the proper lead. Tables are of iron, 24″x48″ and 31″ x48″, respectively, and have planed grooves for the reception of the various fences. Wood packing pieces are put in around the saws, which can be taken out when grooving is to be done, or any work of that class. Improved fences are provided, which are especially strong and convenient. They are provided with scales, graduated to eighths of an inch.

The machine is intended to cut to accurate lengths all kinds of stock from 4″ to 6½ feet in length, and will be found useful in almost

any wood-working shop where much work is done, but especially in furniture factories, where a great deal of work is to be cut accurately to length and square.

SAND-PAPERING MACHINE.

The other illustration represents a combined disk and drum sand-papering machine, which is intended for use in any wood-working shop where there is much finishing to be done by sand paper.

The drums are made of any diameter to suit the requirements, the one shown being 12" diameter and 24" long. The paper is fastened to it by two clamp rods in such a way that a change of paper is very conveniently and quickly made, and it is held firmly to the body of the drum. Carpet or rubber are used for a cushion for the paper.

The disks are composed of well-seasoned pattern lumber, in strips glued and screwed together, thus preventing warping. A very convenient clamping device is supplied, by which the paper is readily secured to the disk and kept smooth.

The table comes quite close to the disk, so that it supports short work, and it is readily removed by loosening the hand-wheels seen below. The shaft is $1\frac{3}{16}$" diameter, and revolves in self-oiling boxes.

The frame of the machine is of hard wood finished in shellac, and with the joints tenoned and drawn bolted, so that it is not only firm, but can be tightened up to compensate for any shrinkage which may take place.

These machines are made by the Cordesman Machine Company, Cincinnati, Ohio.

To San Francisco.

(*Editorial Correspondence.*)

The trip of the eastern members of the American Society of Mechanical Engineers, to attend the spring meeting of the society at San Francisco, began auspiciously by the departure of the special train over the West Shore Road, Wednesday, the 4th inst., at 9:30 A. M. The train was composed of seven Pullman vestibuled sleeping, parlor and dining cars, and was occupied by the following members and their friends:

Ashworth, D. and wife, Pittsburgh; Alden, G. I., Worcester, Mass.; Andrews, Edward and wife, Wilmington, Del.; Boyd, J. F., Erie, Pa.; Borden, T. J., Fall River, Mass.; Betts, Alfred and wife, Wilmington, Del.; Binghurst, Mrs. M. W., Wilmington, Del.; Cogswell, W. B. and daughter, Syracuse, N. Y.; Cotton, W. G., Boston, Mass.; Daniels, Fred H. and wife, Worcester, Mass.; Hibbard, Thomas, South Boston, Mass.; Hunt, C. W. and wife, New York; Haskins, H. S. and wife, Philadelphia; Higgins, M. P. and wife, Worcester, Mass.; Hunt, R. W. and wife, Chicago; Hutton, F. R., New York; Hazard, V. G. and wife, Wilmington, Del.; Harrington, Miss M. E., Bethel, Vt.; Hammett, Mrs. H. G., Miss F. S., and Miss G. L. Richardson, Troy, N. Y.; Jones, Washington, Philadelphia, Pa.; Knickerbocker, John, Troy, N. Y.; Laforge, F. H., Waterbury, Conn.; Lewis, Wilfred, Philadelphia, Pa.; Monaghan, W. F., New York; Moore, D. G. and wife, Elizabeth, N. J.; Mansfield, Mr. A. K. and wife, Salem, Ohio; Martens, F., College Point, L. I., N. Y.; Miller, Fred J., New York; Power, F. M., Syracuse, N. Y.; Parks, E. H. and wife, Providence, R. I.; Roberts, Mrs.; Roux, Ph., Paris, France; Shepard, F. E.; Sharp, Joel and wife, Salem, Ohio; Smith, Geo. H. and wife, Providence, R. I.; Scheffler, F. A., Cleveland, Ohio; Stearns, Albert and daughter, Brooklyn, N. Y.; Smith, Gilbert S., Philadelphia, Pa.; Torrey, H. G. and wife, New York; Trump, Chas. W., wife and two daughters, Wilmington, Del.; Tynan, J. W. and wife; Wellman, W. S., Thurlow, Pa.; Wellman, S. T. and wife, Thurlow, Pa.; Wiley, W. H., wife and daughter, East Orange, N. J.; Williamson, J. D. and wife, Philadelphia, Pa.; Williamson, Wm. C. and wife, Philadelphia, Pa.; Winebrener, Mrs. H. B., Elizabeth, N. J.

The early part of the trip was uneventful, but as Chicago was approached it was seen that heavy rains had made delays from washouts not improbable, the country seeming to be quite generally under water of varying depths.

Chicago was reached at 1:30 P. M. on the 5th, where the party immediately entered carriages and were driven to the grounds of the World's Fair at Jackson Park. First the members tested the virtues of the Columbian movable sidewalk, the company interested in this having an experimental plant in operation on the grounds near the Woman's Building. It is erected upon an elevated structure of wood, nearly circular in form, and consists of three platforms, the outer one being stationary, the middle one moving at about two miles per hour, and the inner one at four miles. It is an easy matter to step from one to another while in motion, and the inner one is provided with seats. It rests upon the tops of numerous truck wheels, while the slower moving one is supported from the axles of these same wheels.

After the members had become satisfied with their experience with this utilitarian merry-go round, they proceeded to the Woman's Building, where, before a large map of the grounds, was erected a small stand from which Mr. H. F. J. Porter, a local member of the society, who is connected with the mechanical engineering work of the construction department, explained something of the work which had been done and which it was still proposed to do on the grounds. He was followed by Mr. R. Allison, who has charge of the Department of Manufactures, and supplemented what Mr. Porter had said; both extending a hearty welcome to the visiting members.

After that the party entered a train of five flat cars which had been fixed up for the occasion, and made a tour of the grounds, not, however, just the tour it was originally intended they should make, because here we encountered our first obstacle in the way of a washout, the sand, of which the surface of the grounds is almost entirely composed, being washed out from under the tracks in one place so that the train could not cross over. Walking had to supplement car riding, and most of the grounds were explored, the greatest surprise being expressed at the magnificent dimensions of buildings and grounds, and at the already apparent beauty and appropriateness of the buildings.

So far as appearance goes, the buildings are to be of stone, beautifully carved, this effect being obtained by structures of wood and iron, which are covered by lathing and plastered. To this is nailed what is called "staff work," which is plaster of paris with jute, cast in molds of the desired form. Among other things of interest seen was in the modeling of colossal statuary, which is to be used for the embellishment of the grounds. This, where a number of pieces are to be alike, is cast, but where a single one is used it is formed by a sculptor, some of the best known of these being now employed in this work, which is entirely under their supervision.

The general opinion among the visiting engineers seemed to be that the work of preparation for the fair was remarkably well advanced, and that the Chicago people deserve the highest credit for the enterprise and energy which they have devoted and are devoting to the work. About one year ago the site was a swamp. Since then one and a quarter million cubic yards of sand and earth have been dredged from what are to be layovers, and the sites of the buildings created. This had to be done before foundations could be started.

When we hear of a building covering 30 acres under its roof, we have a dim idea that this is a large building, but no adequate idea of its real magnitude is gained until it is seen. Though not the largest building, Machinery Hall was naturally the one in which many of the members were most interested, and it is far enough advanced to enable one to gain some idea of its proportions. Originally intended to be 850x550 feet, it is now to be 1,400 feet long, the addition of 550 feet in length being 500 feet wide.

In this building will be three traveling cranes of 75 feet span and running the full length of the building. One of these will be built by Wm. Sellers & Co., another by the Yale & Towne Co., and the third by the Morgan Engineering Co. All will be operated by electricity. The runways will be made by the Edgemoor Iron Works. These cranes will be used in installing the machinery, and then, during the exhibition, will be employed as a sort of elevated railroad, by which passengers will be conveyed, and from which they may obtain a bird's-eye view of the floor. Underneath the steel beams composing the runways will be secured the shaft hangers.

From the power plant connected with this building will be derived all the power used about the grounds and in all the buildings, the transmission being by electricity. About 22,000 to 23,000 horse-power will be generated here, exclusive of that used for pumping water for display purposes, which will be done by a Worthington plant.

The arrangements for the entertainment of the visiting members while within the grounds were in the hands of the local members of the society, who acted the part of hosts for the time being.

Upon the completion of their tour of the grounds, the party again took the carriages and were driven to the shops of Fraser & Chalmers, passing on the way many of the points of interest in the city. Fraser & Chalmers are large manufacturers of mining and refrigerating machinery. Though their shops are large, they are evidently not as large as they should be for the amount of work done, the crowding being quite apparent. Forty draftsmen are employed here. New and larger shops are being constructed.

The train was scheduled to leave Chicago, over the Rock Island Road, at 7 P. M., but about 5 o'clock information came that a good portion of the track west of the city had been undermined and made unsafe by the heavy rains, so that no trains were running. Finally, 9 A. M., Friday, the 6th, was set as the hour of departure, and Fraser & Chalmers, learning of this, sent carriages to the station, in which the party, or at least a large proportion of it, was conveyed to the theater, where they enjoyed the "City Directory," returning by carriage to the station, where the night was spent in the train.

In the morning, the hour of departure was still further postponed to 11 A. M., and the actual time of the start was 11.20, following the "limited express," which, in this case, was limited mainly as to speed, the maximum for both trains being fixed by special order at 6 to 12 miles an hour, according to condition of track.

In this way much time, in addition to the 16 hours at Chicago, was lost, no considerable speed being attained until the Iowa line was reached, after which, and during the night, outside of the flooded district, some fast running was done. Cards and other games, with reading, feasting, smoking and conversation occupied the time during the run to Manitou Springs, Colorado, which were reached Sunday morning instead of Saturday morning, as the unwashed schedule provided.

Another incident of the trip was the repeated leaving of the rails by the rear truck of the engine at a point about 13 miles east of Bellville, Neb.; the wheels being quickly and easily replaced the first time, they almost immediately ran off again, and this time there was more difficulty and a broken brake, resulting in slow and careful running again for some distance and until a new engine was obtained. By this time there were not a few of the party, especially among the ladies, who began to fear that the expedition was ill-fated, and to almost wish themselves back in the country of stone-ballasted and double-tracked roads.

This pessimistic feeling was, however, mostly dispelled by a very pleasant literary and musical entertainment given in the Pullman car Corinthia, under the management of Mr. Louis Cassier, who proved quite a success as an impressario, and succeeded in securing a number of talented artists, who made the evening pass very pleasantly, though, of course, the auditorium was rather small. I append a program, to which should be added an original poem of great merit, describing the journey to that point, written at short notice by Mrs. Higgins, and a recitation by Miss Trump.

GRAND ENTERTAINMENT.

SIXTY MILES AN HOUR.

Special Pullman Train.

IN CAR CORINTHIA, EN ROUTE TO CALIFORNIA.

SATURDAY EVENING, May 7, 1892, 8 P. M.

1. *Realistic Story—Señor Robt. W. Hunt*
2. *Song—A. S. M. E. Quartette.*
Mme. Higgins, Mlle. Stearns, Mons. Hutton and Smith.
3. *Pigs and Razors—A California Story of '49—Señor F. M. Power.*
4. *Duet—Señora Higgins, Señ'ta Stearns.*
5. *Oration—Mons. F. R. Hutton.*
6. *Solo—Mrs. Lofty and I.*
Mme. H. G. Torrey.
7. *Humorous Recitation.*
Mons. De Ashworth.
8. *Guitar Solo—Spanish Danse.*
Signor G. S. Smith.
9. *Lecture—Little Specks of Gold.*
Mons. Torrey.
10. *Guitar Solo with Song—Bangor.*
Mlle. Stearns.
11. *Lecture—Prof. W. H. Wiley, D. D.*
12. *Lecture—Dr. Schoenborn.*

After passing through a snow-storm, Colorado Springs were reached at 9 A. M., Sunday, the 8th. F. J. M.

The Willimantic Engine Breakdown.

On the 30th of April the main shaft of an engine in the mill of the Willimantic Linen Co., at Willimantic, Conn., broke, damaging the engine considerably and destroying some of the walls of the engine room. As usual in a case of this kind, the New York and other daily papers published accounts of the matter that were widely conflicting and quite unreliable. The simple fact about which so much was made is as follows: The engine—a tandem compound—was built at the Hewes & Phillips Iron Works, Newark, N. J., and was of the dimensions as given below. It was intended as one of a pair, the outboard end of the shaft being provided with a crank all ready for connecting the other engine. The account which we take from the Willimantic *Herald* can, we believe, be relied upon as being substantially correct. It will be seen that no blame attaches to the Hewes & Phillips Co. It was one of those accidents that will sometimes happen, and against which no foresight can guard. The engine had not been accepted by the Willimantic Company, so that the loss, which will be quite large, falls on the builders. The *Herald* says:

The Phillips Brothers, of the Hewes & Phillips Iron Works, Newark, N. J., builders of the mammoth engine, arrived in town Saturday night and viewed the wreck. During their stay in town a *Herald* reporter secured an interview with Mr. Phillips, and from him obtained many interesting facts.

The engine, which was of the Corliss type, was a 30-inch high-pressure and 55-inch low-pressure [stroke 60"] working under an initial pressure of 90 to 100 pounds, and developing at the time of breakage 425 horse-power. The fly-wheel and shaft were designed for 1,500 horse-power, and was one of the largest in the United States. The fly-wheel of 28 feet diameter had a 9-foot face, turned crowning for three belts, the largest one in the center of 48-inch width, with a 24-inch belt running on either side. The large belt had not yet been put in position. The engine had been running without any difficulties whatever as regards heating in the main bearings, and was entirely free from any shock or thump when turning the centers. The shaft, which was of 15 and 18-inch diameter [*], broke short off immediately adjacent to the swell which receives the hubs supporting the wheel, and without any previous warning. This permitted the entire wheel, with the remainder of the shaft, crank and main pedestal, in all weighing about 70 tons, to drop directly into the wheel pit, a

[* Fifteen inches at the journals enlarged to eighteen inches for the wheel.—Ed. A. M.]

distance of about two feet. The rim of the wheel, weighing 700,000 pounds [†], was running at the speed of a mile a minute when it came in contact with the bottom and sides of the wheel pit, but the wheel was of such strength that but few of the pieces flew beyond the limits of the engine room. The joints where the rim and arms were secured together remained intact with one exception, the bolts and flanges remaining firm after undergoing the terrible strain.

The Willimantic Linen Company, through their agent, Hon. E. S. Boss, and Superintendent Scott and chief engineer, attribute the disaster to the material of the shaft, believing that the construction of the engine was fully equal to all demands upon it. The engine had been subject to continuous inspection, but the rupture of the shaft was of such a nature as to make it impossible of observation. The company believe that the accident was due to defective forging of the shaft. . . . [‡]

The enterprise of the Linen Company, and their confidence in the engine builders, is evidenced by the fact that an order has been given Messrs. Hewes & Phillips for an exact duplicate of the wrecked engine, which will be ready for use by early fall.

The Paris Workman.

It is very difficult for a Paris workman to be satisfied with his condition. He is far worse off than the London workman, even supposing that his wages are as high as those of the latter, which is not generally the case. The cost of living in Paris is nearly, if not quite, a third more than it is in London. All the necessaries of life are heavily taxed, and the workman pays as much upon the bread, wine, sugar, etc., that he consumes as the great bankers in the Rue Laffitte do, in proportion to the amount. If he tries to escape being gradually poisoned by the adulterated wine especially prepared for him, and has a cask sent to him from the district where it is grown, he pays half its value again in the form of octroi dues when it is delivered to him in Paris. M. Carnot pays exactly the same amount upon wine that may have cost him ten times as much. If the tax is fair in one case, it must be iniquitous in the other.

The practical result of this system is that the workman is almost debarred from drinking pure wine, although he is rightfully entitled to it for the sum that he pays. He is in the hands of dealers who do not care if he is poisoned or not, provided that they can make money by him, and the poisoning process is sufficiently slow to escape detection.

Whenever the proposal to tax capital or income has been made it has met with the sturdiest opposition in Parliament. It is much too republican a measure to suit republican politicians, who are no less anxious than others to keep all that they have and to add to it as much as possible. Then, again, the Paris workman has to contend with the cupidity of landlords, who have not the reputation of being a very scrupulous class of speculators. The smaller the lodging the higher is the rent in proportion. Political economists, taking for their text the latest statistics showing the falling off of the French population, have been amusing themselves of late years by preaching to the working class upon their lack of patriotism in not having larger families. Now, in Paris, the truth of the matter is this: that an ordinary working couple cannot bring up even a couple of children unless the woman has some regular occupation as well as the man. In a large number of cases it is her labor that is the chief mainstay of the home. Considering all the difficulties that the working people of Paris have to contend with, the wonder is that they accept their fate with such good temper and generally show such a philosophical spirit in trying to make the best of it.—*Paris Correspondence St. James Gazette.*

[† Evidently a misprint.—Ed. A. M.]

[‡ It is due to the Hewes & Phillips Company to say that they had the shaft forged by a concern (the name of which we omit) that has always borne an excellent reputation for doing good work. —Ed. A. M.]

Efforts to use steam in a steam engine of a pressure much beyond two hundred pounds per square inch have not been highly successful. But it does not follow that there would not be good economy in the use of steam of a good deal higher pressure than that named if all the conditions for using it were right. The pressure used has been largely increased, generally speaking, within the past few years, and there is no reason for believing that the limit has been reached. As a better means of preventing loss from condensation, better means of providing for lubrication, and better mechanical construction become known, steam pressure is likely to be correspondingly increased, and more of the theoretical advantages of the use of higher pressures will be obtained. With the possibility of gain by higher pressures so well known, there is not likely to be a standing still in the matter. There is, perhaps, no probability of an advance being made by a great stride, but rather a probability that knowledge gained here and there will gradually show the way, little by little. There are many things about the steam engine and the use of steam yet to be learned, and it is an intensely interesting subject for the scientist and the practical man.

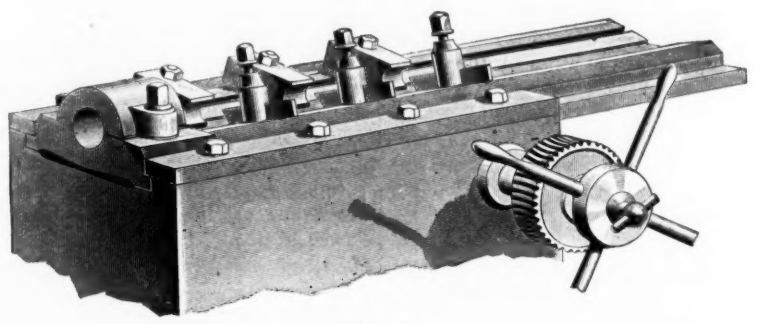
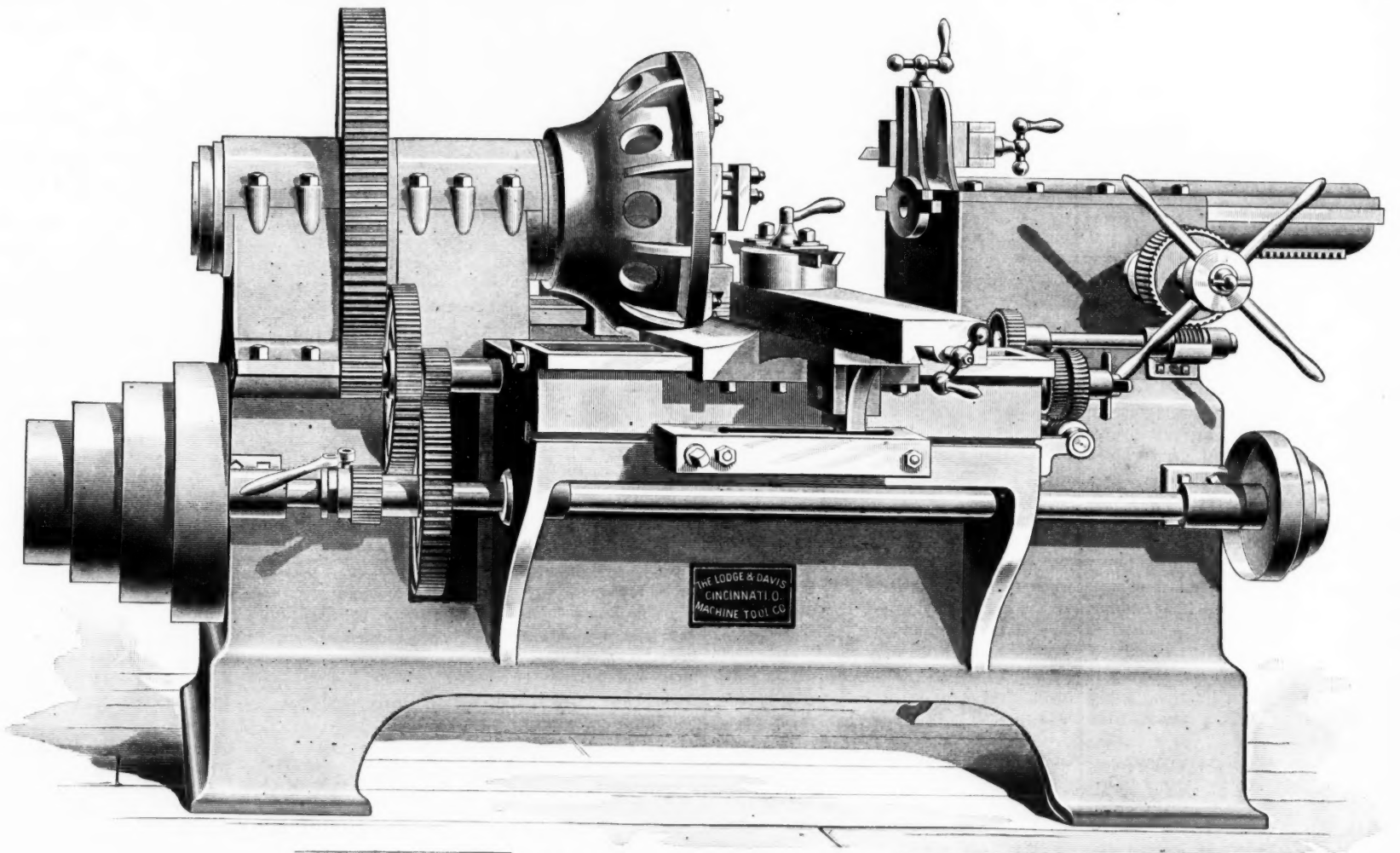


Fig. 2.



NEW THIRTY-SIX-INCH PULLEY LATHE.

New Thirty-six-inch Pulley Lathe.

We herewith illustrate a new 36″ pulley lathe recently brought out by the Lodge & Davis Machine Tool Co., of Cincinnati, Ohio. This tool has several novel features, departing in many respects from tools for the same purpose now on the market.

The bed with the guides for the tool rests, the head-stock and the tail stock, are cast in one piece, making a strong, rigid frame. The guides for the tool rests at the front and back are so arranged that, when turning the full swing of the lathe, the tool slides stand back 5″ from the dovetails, thus enabling the machine to turn pulleys down to 12″ in diameter, without overhanging the slides to an injurious extent.

A revolving turret serves as a tool holder, carrying two tools, one for roughing and the other for finishing. The crowning of the pulleys is accomplished by an adjustable slotted guide, shown in the front of the cut. In accordance with the shape and setting of this guide, any desired crown, straight or curved, can be obtained. In the slot of this guide works a ball-shaped roller attached to the end of a segment, fulcrumed in a recess of the bottom slide, and engaging with a short rack forming the nut for the tool slide screw. The tool slides have power feed in both directions. The head-stock is strongly geared, and has a large driving wheel. By means of a compound sliding gear, operated by a handle in front of the machine, the change from slow to fast speed for turning and polishing can be quickly made. The spindle is of cast-iron, large in diameter, and runs in cast-iron bearings lined in strips with babbitt metal. The machine is designed to turn and bore at the same time, and the chuck, holding the pulley by the arms, has self-adjusting clamps to obviate springing. The tail-stock is provided with reversible power feed, and the hole in the center receives the boring bar that enters the hollow head-stock spindle, which serves as a guide. The front end of the tail-stock slide carries a compound rest, to be used for facing hubs and turning either straight or taper.

This machine was designed by Mr. Henry Dresses, chief designer for the builders.

The machine may also be fitted with a separate slide, as shown in Fig. 2, having at the back of the boring bar clamp, Barker's patent stud-turning device, consisting of a series of adjustable tools and guides. To operate this, the boring bar is removed and a suitable chuck fitted to the spindle, for holding the stock that passes through the head. The stock also passes through the boring bar clamp on the tail-stock, which is provided with a collet and starting tool, thence to the finishing tools This attachment gives to the machine a wide range, adapting it to stud turning and roughing down stock when not engaged in boring and turning pulleys, or in similar work.

LETTERS FROM PRACTICAL MEN.

That Mechanical Sphere—Economy of Steam Engines.

Editor American Machinist:

I wish to take exception to two statements made by Mr. Pentz in his article on "The Mechanical Sphere," in your issue of this date.

1st. The "conic ovate," Fig. 1, does not have a constant diameter, if we use the word diameter in the ordinary sense as a straight line passing through the center. Mr. Pentz uses it in the sense of the distance from one point to the most distant point on the opposite side, which is certainly a new definition of the word.

2d. A circular ring is not the only means by which a sphere may be inspected for truth. It may also be inspected by resting it on three fixed equidistant points, and bringing down upon it the end of a micrometer screw whose axis is at right angles to the plane of these points, and in line with the center of the triangle formed by them. Large spheres may be tested by the spherometer used for testing the curvature of lenses.

Mr. W. B. LeVan says Sulzer Brothers, of Winterthur, Switzerland, guarantee to develop a horse-power with 12 pounds of steam per hour. The lowest figure for water consumption obtained on an actual test that I have been able to find is 12.58 pounds—Prof. Schroter's experiments at Munich. See *Engineering*, December 5, 1890. Can Mr. Le Van refer us to any test showing lower figures? TECHNICS.

Cylinder Oil—Pipe Joints.

Editor American Machinist:

"J.," in your issue of May 5, tells of his trouble with pitted tubes and leaky flange joints caused by different grades of cylinder oil. It is the old story over again, viz., that the best oil for piston and valve lubrication has a varied per cent. of animal oil mixed with the filtered and distilled mineral oil base. Such mixtures are bad for the tubes, flues, or exposed fire sheets of boilers. A straight mineral cylinder oil will not hurt boiler parts, but it is not quite so good a lubricant as the mixture; besides, it has the disadvantage of attacking pipe joints, especially if made of gummy material, like rubber, and where there is a slight vibration. At high speeds, and with a steam pressure above 70 pounds, straight mineral cylinder oil is hardly satisfactory, and the higher the pressure used the larger the percentage of animal oil that will give the best results, so far as lubrication is concerned.

For packing the flange joints I would recommend "J." to use a putty made of one part white lead and two parts litharge, using glycerine enough to get the mass to the proper consistency. The more it is worked the better, but it should not be prepared very long before using. For threaded pipe joints use a thinner mixture of glycerine and litharge instead of the usual red lead and linseed oil. PETER H. BULLOCK.

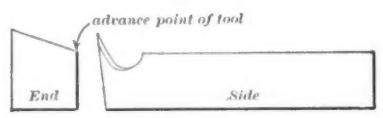
Conveying Sand.

Editor American Machinist:

Replying to letter of J. A. L., in issue of May 5th, I would suggest the use of a horizonal conveyer connected with each machine by a hopper and conveyed to the point where he wishes to mix. From this mixer the sand could be dropped into a boot and from there elevated to the necessary height by a bucket and chain elevator, and dropped into one end of a horizontal conveyer with outlets at each machine; the connections from machines to this last mentioned conveyer should not be made direct, but the sand should be dropped into storage bins of say 1½ times capacity of machine, and these bins provided with appropriate outlets easily opened and shut with a slide.

The conveyers should be either the screw type or a series of flights on an endless chain running over sprocket wheels; in each case a continuous trough should be provided, and if chain and flights are used the trough should be of iron, lined with heavy glass, to prevent unusual wear. This trough at each bin should have an opening in the bottom, provided with a slide, so that in case of necessity the bin need not be filled.

T. R. B.



Turning Paper.

Editor American Machinist:

J. H. S., in Question 102 of No 11, asks about tools to turn paper. I have turned quite a number of paper friction pulleys of all sizes up to 4 feet, and the tools that have given the best satisfaction were about the shape shown in sketch [which is the same as has been previously shown.—ED.], and tempered to nearly a copper color; have very little clearance, and run same or slower than for turning iron; feed according to kind of finish desired. I have used as much as $\frac{3}{8}$" to 1 revolution. Feed of $\frac{1}{16}$" will leave a burnished surface.

I have seen a tool like this one at work and doing a good job; it had very little end clearance and was ground quite thin. J. G.

Sending Catalogues.

Editor American Machinist:

It has been my practice for a number of years to collect catalogues. I am not in business, and shall not be for three years yet, and only then at a very small beginning. I have not paid much for catalogues, but consider my collection quite valuable.

I have indirectly been the means of the issuers of catalogues making many a sale. I was lucky enough to have a position of constructing engineer for a blast furnace and mining company a few years ago, and part of my duty was to make out requisitions for supplies. These were ordered by the secretary and treasurer in the name of the company. His signature was good on a check, and good on an order for goods; mine was not, but it was generally good on a postal card for a catalogue. The responsibility of deciding what we needed, and how much, and where it could be obtained, and the quality obtainable from the different competitors, fell upon me. In order to make estimates and designs and lay out work, I needed information which could be obtained from the catalogues of the manufacturers, sometimes months in advance of the purchase of the goods. It may have seemed to some issuers of catalogues that when they sent me a catalogue in answer to a postal, they threw it away, because they did not obtain an order with my signature, and when they received one from my employers they did not realize that their sending me a catalogue had anything to do with it.

It is not every one that has had his reward for sending me a catalogue. Sometimes one is selected and another is left.

But that is not all The catalogue is saved, is seen by business men, its contents discussed, and orders have been given which would not have been given but for that.

I have heard some business men speak of the accumulation of catalogues as if it troubled them, and once in a while they would have a cleaning out and throw away a number of them. I never sent for a catalogue unless I wanted it, and I never threw one away.

I consider it the privilege of every dealer to decide for himself as to how and how much he shall advertise, and when I receive a frank declaration that the company applied to does not care to send me their catalogues because they are not sure of my eligibility, I always respect their frankness, and think that they would be square people to deal with. But when I receive a letter stating that the catalogues are out of print, and happen to know to the contrary, then I set them down as fakes, and if an occasion comes up, some one else gets the order. I do not send for a catalogue when I have no use for it; for it is too much trouble, and they take up too much room.

BOYLSTON.

Detachable Valve Gears.

Editor American Machinist:

The communication of "Observer," in your issue of May 5th, referring to the inventions of George H. Corliss—inventions in which all Americans take just pride, and in regard to which, if they are of that disposition, they have a perfect right to do any boasting that their inclinations may lead them to indulge in—suggests to the writer some interesting omitted points in the history of that class of devices in this country.

Mr. Corliss was anticipated in the invention of the detachable steam valve by Frederick Ellsworth Sickels, who patented his drop cut-off in May, 1842; and it was claimed by the friends of Mr. Hogg, of the old Delamater Iron Works (then Hogg & Delamater), that the older inventor, in whose shop Sickels was then apprentice, had devised that plan still earlier. Sickels certainly used the dash pot, also anticipating Corliss in this point by seven years. When Corliss brought out his engine, about 1850, Thurston, Green & Co. had owned the land rights and had been building the Sickels engine as a mill engine for some years, and were doing, for the time, a very good business. Sickels, himself, was building marine engines also, and the Sickels valve gear was well known throughout the world. In 1862, at the International Exhibition, it was exhibited as a German invention.

Neither Sickels nor Corliss was first to use a governor to determine the point of cut off in regulation of the speed of the engine. That was done at least as early as 1834, and by Mr. Zachariah Allen, of Providence, R. I., and possibly by others; but Mr. Corliss was adjudged, by the courts, to have been the first to attach the governor to *a detachable valve gear*. In this the courts were sustained, I think, by the judgment of the best informed members of the engineering profession; but the dash-pot was no new thing, and was not adjudged exclusively his, except as applied to his peculiar form of valve gear. The device was covered by the Sickels patents of 1842, and open to the world after their expiration. It had actually been in use long before the Corliss inventions were brought into practice.

The criticisms of the French cam by your correspondent are, I think, in the main, correct. It was a well known system in the days of the Sickels and Corliss inventions, and was, in fact, a very fairly satisfactory arrangement for the time. Mr. William Wright, then of Hartford, built many engines on that plan, and they did what was then—and until the Corliss engine displaced it by still better performance—considered excellent work. It did, however, illustrate the attachment, prior to Corliss, of the governor to determine the point of cut off, and gave what was, at the time, satisfactory regulation when properly made and adjusted. Modifications of this gear are still occasionally seen, and sometimes of recent construction. R. H. THURSTON.

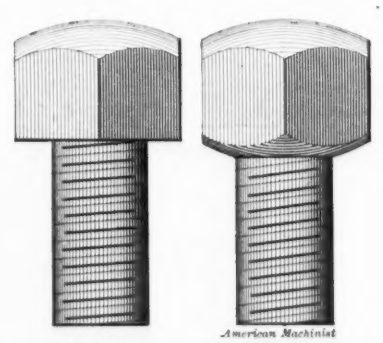


Fig. 1. *Fig. 2.*

Set-screws.

Editor American Machinist:

We often hear and read of accidents to workmen by their clothing being caught by revolving set-screws. Set-screws cannot be dispensed with entirely, but the danger of catching clothing can be greatly lessened by never using one with square shoulder under the head, thus avoiding sharp corners at the lower part of head. The square shoulder answers no good purpose, the point being the part in contact.

I find some makers leave the lower corners chamfered. Any one who will take two set-screws, one with square or sharp corners, as in Fig. 1, and one like Fig. 2, with chamfered corners, hold them by the threaded part and draw the head along his clothing, will find how much easier one catches than the other. W. S. CHAMBERS.

Plumbago vs. Oil as a Lubricator for Steam Cylinders.

Editor American Machinist:

In your issue for May 5th "J." relates his troubles from the use of various cylinder oils causing leaky joints. Several years ago I was troubled with the same thing. I quit using oil or grease of any kind and substituted therefor powdered plumbago. A common tallow cup was placed on the steam chest; a quantity of about 400 grains for each half a day's run was placed in the cup, and to it was added a small quantity of water. The latter was not absolutely necessary, but it seemed to feed a little better with it.

A full account of the result of this change of lubricator was published in the AMERICAN MACHINIST when it was yet a monthly paper; the date is forgotten. However, since then the Atlantic Dredging Company, of Brooklyn, N. Y., had considerable trouble with grease lubricators. They abandoned them and resorted to plumbago and their troubles ceased, and so will "J.'s.," it is believed, if he abandons oil as a lubricator in his steam cylinders.

WM. J. WILLIAMS.

System of Prime Costing.

Editor American Machinist:

From time to time I have noticed various articles on the above subject in your paper, but up to now not just the thing I want. I might no doubt alter my conditions to suit one of the various schemes, but I would prefer to find a scheme to suit my own conditions.

I employ about 70 hands in the manufacture of light and medium machine tools and special machinery, and being one of the believers in piece-work, I adopt it as far as possible. There are, however, many cases in which piece work cannot be adhered to, notably in new pattern machines, and in cases where special urgency necessitates putting two or three machines through the shops in a hurry, instead of a dozen, as we usually try to do.

We, of course, subdivide our tools into details—head stocks, carriages, slide rests, etc., and we want a system of keeping costs of same accurately and simply. I have devised various schemes myself which would answer all right, only I find that they would involve so much extra work that they would probably cost more than their use would save.

I have seen a very complete system in operation, in which a ticket is issued with each piece, and this ticket follows the piece through all the processes required, from the forge to the erecting shop, each man engaged on the job having charge of the ticket as long as he is working on the job, and entering each day the number of hours worked, and particulars of the operation; then, when the piece is finished, the ticket is handed into the office, and, if correctly kept, bears a record of the actual cost of the article, leaving the office to add the amount which is considered proper for establishment expenses, and which usually consists of a percentage on the total labor.

This is very good in cases where the work is all day-work, but piece-work causes complications at once; besides, the tickets are very liable to be lost, especially when the job happens to be a long time in the shops; it also takes quite a lot of time to keep track of the tickets.

Doubtless some of your readers have found the same difficulty as myself, and have found a good way out of it, and possibly some of these will be charitable enough to tell us all about it, for the benefit, not only of myself, but for the scores of men who are in just the same case as I am.

ANGLO-AMERICAN.

Those Locomotives.

Editor American Machinist:

Mr. W. E. Crane, in your issue of April 14, has enlarged the subject that has been discussed in your columns recently by Messrs. Clough, Bell Crank, and the writer. We had only tested the efficiency of the locomotives with a maximum load at a "go-as-you-please" gait. Mr. Crane introduces the important factor of speed, thereby greatly increasing the interest in the subject. It is to be regretted, however, that he did not give us more information in regard to the course he took to obtain about the same results with these engines in passenger traffic that Mr. Clough did when coupled to freight; *i. e.*, he says the 18x22 does the most work, but does not say why it should; therefore I will investigate and see, if I can. If not, then Mr. Crane will please "rise and explain."

Taking the examples in the order he has given them, and subjecting them to the formula given by me in your issue of March 3, we have for the first example

$$\frac{18^2 \times 22 \times 60}{68} = 6{,}288 \text{ pounds.}$$

For the last example we have

$$\frac{16^2 \times 26 \times 60}{60} = 6{,}656 \text{ pounds.}$$

The engines traveling at 40 miles per hour gives a velocity of 3,520 feet per minute; hence, for the first example we have

$$\frac{3{,}520 \times 6{,}288}{33{,}000} = 670 \text{ H. P.,}$$

and for the second example

$$\frac{3{,}520 \times 6{,}656}{33{,}000} = 740 \text{ H. P.}$$

Mr. Crane's figures, it will be remembered, for the 18x22 are 714 H. P., and for the 16x26, 711. If he looks at them again, I think he will find they need revision, else Mr. Clough's claims are right.

I will also differ with Mr. Crane in the opinion he has expressed that it will require higher engineering ability to design a valve gear for the 16x26x60 than for the 18x22x68, on account of the increased piston speed of the former when running at the same number of miles per hour. To illustrate: Design both engines just alike, except the pistons and wheels, which shall be 16x26x60 in the one case, and 18x22x68 in the other, then give them both the same load and the same time to haul it, and they will both use the same amount of steam, and as it has the same sized passages to go through, and the same time to go through them, there can be no difference. This idea may be better illustrated by supposing that we have two stationary engines, both identical, except one is 16x12, the other 8x48, both to run 100 revolutions per minute. When we start up, there is no reason why we should not get duplicate indicator cards from each engine, although the one has a piston speed of 800 feet per minute and the other but 200 feet per minute. Piston speed is important only when considered with something else.

I will call the reader's attention to some locomotives illustrated and described in *Locomotive Engineering* of May, 1891, as bearing directly on the subject under discussion.

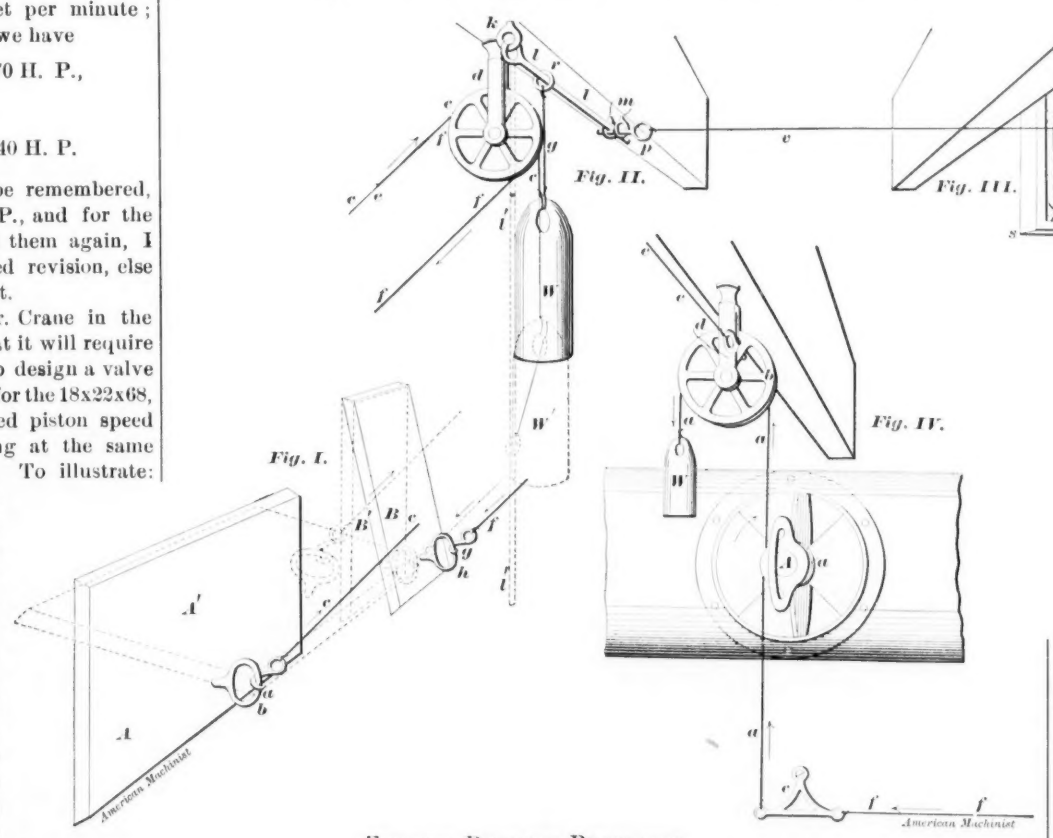
These engines pull the "Royal Blue" trains from New York to Washington, D. C. The average speed is 45.5 miles per hour, including stops. Much of the distance between stops is covered at the rate of 60 miles per hour, and a part of it (two miles down grade) at 70. The trains are the same, each weighing 294,000 pounds, and the locomotives 187,810 pounds, or a total of 215 tons. At the speed these trains travel, it will require about 30 pounds per ton to overcome the resistance on a straight and level track, which will require a locomotive having a tractive efficiency of 6,450 pounds. One class of these locomotives have cylinders and wheels 19x24x68, the other 20x24x78. Both classes give good results, and have their respective admirers. These engines may be as easily compared as the others, and as the result will be of interest, I will make the comparison. Taking the big one first, $\frac{20^2 \times 24}{78} = 123$ pounds per pound average effective pressure on the piston. The smaller engine will show $\frac{19^2 \times 24}{68} = 127$ pounds per pound average effective pressure on the piston. If the train resistance (6,450) is divided by these amounts, the quotient will be the average effective pressure on the pistons of each engine, which, for the 20x24, is 52.5, and for the 19x24, 50.7 pounds. It will be seen from these results that the gentlemen who designed these engines knew what they were doing. The horse power they develop would be $\frac{6{,}450 \times 5{,}280}{33{,}000} = 1{,}032$ H. P.

C. O. SINE.

Furnace Draught Regulator.

Editor American Machinist:

Several years ago I constructed a simple attachment to my furnace, by means of which the cold air damper and draught slide were automatically adjusted at any assigned hour in the morning. Any person of a mechanical turn may, at a moderate expense, fit up one for himself. I have recently made some improvements, and will begin by describing the arrangements for a large furnace, which differ from those for a small one.



FURNACE DRAUGHT REGULATOR.

In a large furnace there are two doors to manipulate—Fig. 1, a draught door *A* and a check draught door *B*. These doors, represented by full lines, are shown in the position they usually occupy during the night, the draught door *A* being closed, and the check draught door *B* open.*

When the attachment is made for the night a hook *a*, Fig. 1, connects with the draught door at *b*. The hook *a* is at the extremity of a line *c c* which passes over a pulley *d*, Fig. 2, and terminates at a weight *W*. The line *c c* may be a gut line, picture wire, or a light brass chain. The latter is preferable.

The weight *W* is sufficient to keep the door *A*, Fig. 1, open in the position *A'* shown by broken lines, when there is nothing to interfere with it. The pulley *d* is hung from the joist. Attached to the line *c c*, Fig. 2, at a point *e*, is another line *e f f f*, which also passes over the pulley *d*, and ends in a hook *g*, Fig. 1, connecting with the draught door at *h*. It will be seen that, when the weight *W* is allowed to descend, opening the draught door *A* by means of the line *c c*, the line *f f* connected with it, moving in the direction of the arrows, will allow the check draught door to close by its own weight.

Screwed into the joist, Fig. 2, is the eye *k* supporting one end of a long light round rod or lever *l l*, at the other end of which are two eyes *m m* screwed into the joist, between which the rod *l l* is placed when set for the night, as shown in the drawing. The pin *p* passes through these eyes, and the lever *l l* rests upon it.

A short line *q* attached to the weight *W* ends in a ring *r* which hangs upon the lever *l l*. This is so adjusted that the weight is entirely supported by the lever during the night, allowing the draught door *A*, Fig. 1, to remain closed by its own weight.

Fastened to the joist, Fig. 3, is a wooden box *s s s*. It is provided with a sliding door *t t*. After setting an alarm clock at the required hour, the clock is placed in this box, face inwards, and the sliding door *t t* is closed, leaving exposed nothing but *u*, the winding arbor of the alarm. To this is attached a line *e e*, the other end of which is fastened to the pin *p*, Fig. 2, referred to above.

When the alarm "goes off," the winding arbor *u*, revolving by the uncoiling of its spring in the direction of the arrow, winds up the line *e e*, disengaging the pin *p*, which falls into the position indicated by the broken lines *v' p'*. The rod *l l* is released, and falls into the position shown by the broken lines *l' l'*. The weight *W* falls to *W'*, opening the draught door *A*, and allowing the check draught door *B* to close—indicated now by broken lines—the former at *A'* and the latter at *B'*. The full lines represent the situation of the various pieces during the night; the broken lines show the same pieces after the alarm has gone off. The weight of the draught door, the check draught door and *W* should be so adjusted that these doors may be worked together, as shown in the drawing, or independently—since there are occasions when it is desirable to leave the check draught door closed. A fine gut line *e e* will answer for connecting *u*, the winding arbor of the alarm, with the pin *p*.

For a dwelling house furnace or stove Fig. 4 illustrates a simple arrangement. A light chain *a a a* is passed round and fastened to the projecting part of the cold air damper *A*. This chain passes over and is fastened to the pulley *b*, ending in a light weight *W*. The other end of *a a a* is attached to the bell crank *c*. A light frame of wood is built round the furnace, carrying a system of two or more bell cranks connected by wires, by means of which the draught slide in front of the furnace is operated. During the night the pin *d* locks the pulley and prevents the weight from descending. When the alarm goes off, the pin *d*, fastened to the line *e e* connecting it with the winding arbor of the alarm, is disengaged from the pulley, and the weight *W* descends, revolving the cold air damper in the direction of the arrow, and by means of the bell cranks which are connected by wires *f f*, etc., the draught slide at the ash-pit door is opened.

The chain *a a a* should be fastened to the cold air damper *A* and to the pulley *b*—in each case at a single point by a rivet or pin, to prevent it from slipping on the surface. This point should be considered, making allowance for the free action of the chain on either side of it.

FREDERIC R. HONEY.

* In order to bring the illustrations within the limits of these columns the drawing, Fig. 1, is unavoidably placed very close to Fig. 2. The reader, while perusing the description which follows, should bear in mind that Fig. 1 is supposed to be removed several feet to the *left* and *below* the place it occupies on the page.

Night Watchmen.

Editor American Machinist:

I have a matter that I think so important to manufacturers that I believe it worth publishing. It is in regard to night watching. The usual way is to employ a trusty man who is expected to work seven nights per week, of about thirteen hours each. In large cities men often live so far out that fourteen hours is about the time a man is away from home. It not being natural for a man to sleep in the daytime, steadily, he naturally is sleepy at night, and in his usual rounds walks in his sleep. There have been many bad fires, when the electric buttons had been pushed regularly, and the fire not discovered. These were probably cases when the watchmen were walking in their sleep (*a machine*). Many of our firemen count an alarm, realize that they must go, and do not really awake until they run against something. Now a remedy for this trouble is to employ two men, one to begin when the business starts at, say one o'clock, having some work laid out that he can do, and when the whistle sounds at six he immediately starts his watch, remaining until, say 11.30. The second man comes on at this hour and remains until twelve M. This costs for watching only one man's wages. I am about arranging for a customer this system by making the fireman do this work, one man firing until noon, the other taking his place. By changing every other Sunday the men have last half of night and first half of day for one period, and the reverse of this for the other. There will be no hardship by one man getting home by twelve o'clock midnight, and either man can get better sleep and rest than trying to sleep by daytime alone, especially in hot weather. I have spoken to our chief of fire department and several insurance men of this plan, and they fully indorse it. This is quite lengthy, but I think it may be worth some consideration.

CHARLES F. ELMES.

A noticeable feature of the World's Fair at Chicago next year will be a complete model of the entire plant of the H. C. Frick Coke Company, of Scottdale, Pa. This company is the largest of the kind in the world. The contract for the model has been let to the Jones Brothers Company, of 30 Court street, Cincinnati, O. The estimated cost of this model is between three and four thousand dollars. The plant will occupy a space about 20x50 feet, made on a scale of one-twentieth of an inch to the foot, and will be an exact fac-simile of the original, including boilers, engines, piping, elevated tracks, cupolas, cars, and all other machinery, and will be in operation, driven by electricity.

The two largest coal and iron companies in the South—the Tennessee Coal and Iron Company and the Debardeleben Coal and Iron Company—have consolidated. The property includes seventeen blast furances and several coal mines.

AMERICAN MACHINIST

Communications relating to the reading columns should be addressed to the Editor. All other communications should be addressed:

AMERICAN MACHINIST,
203 BROADWAY, NEW YORK.

PUBLISHED WEEKLY AT
203 Broadway, New York.

HORACE B. MILLER, Pres't and Bus. Manager.
LYCURGUS B. MOORE, Treas. and Sec'y.

F. F. HEMENWAY, Editor and Mech. Engineer.
J. G. A. MEYER, } Associates.
FRED J. MILLER, }

Special Announcements.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.*

Subscription.

$3.00 a year in advance, postage prepaid, in the United States, Canada, and Mexico.
$4.00 a year to Other Countries, postage prepaid.

Advertising.

Transient, 35c. per line, each insertion.
"Business Specials," 50c. a line.

The American News Company,
Publishers' Agents, New York.
DEALERS SUPPLIED BY
The Albany News Company, Albany, N. Y.
The American News Company, New York, N. Y.
The Baltimore News Company, Baltimore, Md.
The Brooklyn News Company, Brooklyn, N. Y.
The Buffalo News Co., Buffalo, N. Y.
The Central News Company, Philadelphia, Pa.
The Cincinnati News Company, Cincinnati, Ohio.
The Cleveland News Company, Cleveland, Ohio.
The Colorado News Company, Denver, Colorado.
The Detroit News Company, Detroit, Mich.
The International News Company, New York, N. Y
The Minnesota News Company, St. Paul, Minn.
The Montreal News Company, Montreal, Canada.
The National News Company, New York, N. Y.
The Newark News Company, Newark, N. J.
The New England News Company, Boston, Mass.
The New Orleans News Company, New Orleans, La.
The New York News Company, New York, N. Y.
The Northern News Company, Troy, N. Y.
The Omaha News Company, Omaha, Neb.
The Pittsburgh News Company, Pittsburgh, Pa.
The Rhode Island News Company, Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The South West News Company, Kansas City, Mo.
The St. Louis News Company, St. Louis, Mo.
The Toronto News Co., Toronto, Ontario, Canada.
The Union News Company, New York, N. Y.
The Washington News Company, Washington, D. C.
The Western News Company, Chicago, Ill.
The Williamsburgh News Co., Brooklyn, E. D., N. Y.
The Wisconsin News Company, Milwaukee, Wis.

The International News Company,
BREAM'S BLDG'S, Chancery Lane, LONDON, E. C., ENG., or Stefanstrasse 18, LEIPZIG, GERMANY, will receive subscriptions for the AMERICAN MACHINIST, at 16/6 per annum, English currency, or 17 marks per annum, German currency, postpaid.
Subscriptions received in Paris, France, by E. TERQUEM, 31 Boulevard Hausmann, at 20 francs per annum, postpaid.

Subscriptions received in Australia by W. WILLIAMS, 17 and 21 Fink's Buildings, Melbourne.

NEW YORK, MAY 19, 1892.

CONTENTS.

	PAGE.
Die Slotter	1
New Pipe Threading and Cutting Machine	1
The Buzz Planer. By John M. Richardson	1, 2
Machine Guns	2
On Compounding Centrifugal and Load Governing by a Rotary-piston Valve. By Wm. S. Aldrich	2, 3
Improved Double Cut-off Saw—Sand-papering Machine	3, 4
To San Francisco	4
The Willimantic Engine Breakdown	4, 5
The Paris Workman	5
New Thirty-six-inch Pulley Lathe	5
Letters from Practical Men: The Mechanical Sphere—Economy of Steam Engines. By Technics... Cylinder Oil—Pipe Joints. By P. t r H. Bullock ...Conveying Sand. By T. R. B .. Turning Paper. By J. G ...Sending Catalogues. By Boylston....Detachable Valve Gears. By R. H. Thurston....Set-screws. By W. S. Chambers....Plumbago *vs.* Oil as a Lubricator for Steam Cylinders. By William J. Williams....System of Prime Costing. By Anglo-American ... Those Locomotives. By C. O. Sine ...Furnace Draught Regulator. By Frederic R. Honey....Night Watchmen. By Charles F. Elmes	6, 7
Shipbuilding in the United States	8
Technical Books	8
Some Perpetual Motion Schemes	8
Questions and Answers	8, 9
Pattern Making. By P. S Dingey	10
Picked Up in the Shops. By Fred Herbert Colvin	10
Manufactures	11
Machinists' Supplies and Iron	11

Shipbuilding in the United States.

The signs point to a gradual revival of American shipbuilding. The passage by the House and Senate, of the bill permitting American register for the Inman liners, the City of New York and the City of Paris, is generally looked upon as giving the impetus needed for that purpose. By the provisions of this bill the Inman Company, in order to obtain the presumed advantages of American register for the two ships named, must build, in this country, two others equal to these in all respects.

Those who favor the bill, which certainly does not appear in any sense to be a party measure, lay considerable stress upon the fact that with the City of New York, the City of Paris, and the two ships to be built, the government would have under its control four swift cruisers for use in case of war. This is, undoubtedly, amatter of considerable importance.

The building here of the two ships referred to would furnish work for some of our shipyards, and incidentally give a little work to iron and steel makers. This may not amount to very much, but it is worth something. Aside, however, from the immediate advantages, there is the important one of helping to get and to keep the yards in condition for further similar work, on private contracts or for the government.

It follows that if what is looked upon as a concession to one company—the Inman—is made, it is likely to be demanded by other companies. The bill appears to be in the nature of a compromise be'ween those who, on the one hand, believe that all vessels sailing under the American flag should be built in this country, and on the other hand those who believe that Americans should be free to buy their ships where they choose. As in the instances of all compromises, there is no telling where this will end. If it shall result in the establishment of other transatlantic lines of American steamships no one will look very closely into the comp omise by which it shall be brought about, provided the government is not called upon to assist too extensively. The best way for any country to develope foreign trade is under its own flag; there is little reason to doubt that American manufacturers would sell much more abroad than they now do if more of the carrying business was done in vessels sailed under the American flag.

The question of the cost of building large steamships here, as compared with the cost in Europe, will, of course, have a good deal to do with further efforts in the same direction as in the instance of the Inman line, and the comparative wages of American and European officers—the ships must be officered by Americans to meet the requirements of the bill—will also have an influence. Altogether the experiment is one that will be watched with interest, and from which a good deal may be learned.

Technical Books.

A well-known mechanical engineer recently remarked—many others have doubtlessly made equivalent remarks—that there are too ma y technical books, "pocket" books and the like—on mechanics and engineering published. To a certain extent this may be true; that is, to the extent that too many books of the kind named are hastily compiled, thrown together as it were, bristling with inaccuracies. But, on the other hand, it must be remembered that a good deal of variety in such works is desirable. Those whose education is of the right kind for the purpose may be entirely satisfied with the works of Rankine, and actually see little need for anything else on, for instance, the steam engine and calculations relating thereto, but to the great majority of men, not only those who operate, but those who design and build steam engines, the mathematical treatment of the subject by that eminent author is useless. It must be treated in quite a different manner to be of any practical value to such men

Then again men have a choice in the style of technical books they use and read, the same as in other literature. While a fact is always the same, there is often a wide difference in the way it is stated, hence there is a demand for variety in books on the same subject stating the same facts, only in different ways There can hardly be too many technical and mechanical works if facts alone are stated. The variety in the way of making the statements will insure a more general use of such books, and tend to th spreading of desirable information amongst mechanics. By many school men the more concise statements of writers who reduce almost everything to mathematical formulas may be preferred, but for the most of those who use technical books somewhat as they use tools in their work, a more simple treatment is required. It is largely, but not altogether, a matter of education; prejudice has a good deal to do with it, and prejudice is not easily overcome.

Some Perpetual Motion Schemes.

We frequently run across perpetual motion devices in one form or another, and we are somewhat accustomed to being bothered by those who believe in them, but just now there seems to be something of an epidemic of perpetual motions, the attacks being usually in the most virulent forms.

One man insisted that he had solved the problem by a system of gearing. He did not call it a perpetual motion device—they do not usually give it that name nowadays—but it was a device, which, by passing the power from an engine or other motor through it, much more power could be taken from it than could possibly be derived from the engine. It had been tried, and this fact had been proven beyond doubt. The device consisted mainly of a ring spur gear, *i. e.*, a gear without hub or arms, which was driven by a pinion keyed to the engine crank-shaft. This ring gear drove another pinion of the same size, which was on the shaft to be driven, and was supported in position by a roller placed inside under the rim and *nearer the driven pinion than the crank-shaft pinion*. The unbalanced weight of the ring gear gave a tremendous pressure upon the teeth of the driven pinion, and the inventor declared made the device yield at least 40 per cent. more power than the engine alone was capable of developing. When an attempt was made to show him that this was impossible, he silenced all argument by declaring that it had been tested by competent engineers and found to be a fact. All he wanted at that time was to get a method of arranging the bearings of the driven shaft in such a way that they would stand the pressure, and —some money to push the matter.

Another inventor had what was practically an old-fashoned chain pump, only instead of disks he had light brass cylinders soldered up tight and filled with air. These passed up through a vertical tube which was filled with water, the hole at the bottom through which the cylinders entered being a watertight fit upon them. The water was expected to buoy up these hollow cylinders and thus keep them continually moving upwards to furnish the power. The descent was made through the air outside the tube, sprocket wheels being placed above and below, over which the chain carrying the cylinders was to run.

A third man had got hold of the fact that centrifugal force increases as the square of the velocity, and from this he concluded, that it was only necessary to provide a small pulley and a belt, driving arms sufficiently long to give the required force, *and power*.

Another device we cannot describe because we are not sufficiently acquainted with it; but we understand that it is only necessary to turn a small handle, the effect of which is to compress a small quantity of air. The machine then starts, and as it goes it compresses more air, keeping the supply of compressed air up to the requirements at all times, and furnishing power in abundance. As we have not seen this nor had it described to us, we cannot, of course, say much in its favor; but there must be something in it, for we understand that a prominent capitalist and public-spirited man is interested in it and has secured an option upon it. But he did not do this without first investigating the matter, as is the habit of all good business men. He went to see it and took along a "cold blooded engineer," who investigated the thing; it was upon his opinion that the option was secured.

But the most curious feature of the epidemic, perhaps, is the fact that the U. S. Patent Office has recently granted a patent upon a genuine perpetual motion device. The patent is dated March 15, and the device is part of a typewriter, its office being to keep the ribbon properly stretched. Besides being a perpetual motion device, it is a very old device for that purpose, essentially the same thing having been illustrated in books at least twenty years ago. It consists essentially of a disk intended to revolve in a vertical plane, and having pivoted at intervals at its side small arms carrying weights at their outer extremities. There are also little pins placed in the side of the disk in such a way that, as the arms are upon the ascending side of the disk, they drop down and let the weights approach the center of the disk; but when they are upon the descending side of the disk they fall against the pins and are kept at the maximum distance from the center of the disk. It is true that this device is not to be used to generate motion, but to resist it, its purpose being to resist the motion of the ribbon as it is wound upon the opposite spool. But, of course, if it will continually resist motion more than that due to its friction, it would produce motion in the opposite direction, and it is nothing more nor less than a perpetual motion device pure and simple. The patent includes a claim upon this as part of the invention. It will be perceived we think, from what we have said, that perpetual motion schemes still live, and not only this, but those who have faith in them occasionally receive some encouragement, even from "cold-blooded" engineers and from the U. S. Government.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(217) Reader, Wilmington, Del., writes: Please inform me if there is a bevel protractor or similar tool made, which will read minutes as well as degrees, and by whom it is manufactured? *A.*—There is no bevel protractor made that reads to minutes; but arm protractors with vernier read to minutes. They can be obtained of Keuffel & Esser, 127 Fulton street, New York, and other dealers in mathematical instruments.

(218) R. S. V. P., Braddock, Va., writes: Kindly inform me through your columns where I can get a book on the theory of pattern making. I have a class of boys and would like to instruct them in this trade. I have worked at this business myself for a few years and have a fair knowledge of it. *A.*—It seems to us that the book entitled "Machinery Pattern Making," by P. S. Dingey, noticed in our issue of February 11, current volume, will answer your purpose. It is published by John Wiley & Sons, 53 East Tenth street, New York.

(219) A. L. D., New York, writes: Please inform me through your Question and Answer columns of the greatest pressure carried through rubber hose or other flexible tubing. *A.*—The greatest pressure which a hose can resist depends on the diameter and quality of the hose. We have known a rubber hose ⅝ inch internal diameter attached to a hydraulic press working under a pressure of 500 pounds per square inch. It is also claimed that a 2 inch hose properly made can resist a hydrostatic pressure of 400 pounds per square inch at a temperature of 60 degrees Fahrenheit.

(220) M., Findlay, Ohio, asks: What is the best way to temper tools for turning chilled rolls? *A.*—We do not certainly know the *best* way to do this. What would seem best to one mechanic might not seem so to another. We believe that with good steel as good a way as any is to heat in a clean fire, preferably of charcoal, to the proper

heat and quench outright in pure water, or water in which salt has been dissolved. 2. Please give me a rule for making common nut wrenches. *A.*—You will find an illustration of a wrench and rules for proportioning its different parts in our issue of December 3, 1887.

(221) W. W., ——, asks: Can you name a machinist's hand-book giving simple rules for figuring the change gears for a lathe for cutting screws? Most of the boys who are learning the trade cannot figure in the higher branches. *A.*—There are a number of books which give simple rules for this, and none of them require any but simple computations. No boy who hopes to become a good machinist should be satisfied until he has at least thoroughly mastered the simple rules of arithmetic, including common and decimal fractions. Without a knowledge of at least this much he will be seriously handicapped, and this much can be easily learned by any ordinarily intelligent boy who is determined to learn it; and with this much learned there will be no difficulty in computing change gears for the lathe.

(222) F. F. B., Trenton, N. J., writes: Kindly inform me through your columns how to find the horse-power of a turbine wheel. Take any size as an illustration. *A.*—Multiply the cubic feet of water discharged per minute by the weight of one cubic foot of water at average temperature. Multiply this product by the height of the head and divide by 33,000; this gives the theoretical energy. In all wheels the actual horse-power is less than this; hence the theoretical energy must be multiplied by the percentage of the power utilized as found by experiment, so as to obtain the net horse-power. For example what is the horse-power of a wheel which discharges 3,000 cubic feet of water per minute under a head of 14 feet, utilizing 80 per cent. of the full power of the water? Taking the weight of water at 62.5 pounds per cubic foot we have $3,000 \times 62.5 = 187,500$ pounds; this multiplied by the head gives $187,500 \times 14 = 2,625,000$ foot-pounds, and $\frac{2,625,000}{33,000} = 79.54$ for the theoretical energy, and $79.54 \times .80 = 63.63$ for the net horse-power.

(223) M. F. G., ——, Penn., writes: I am going to make a small engine for myself, and I shall be pleased if you will give me a few pointers in regard to the same. I have my own ideas; at the same time I am not an efficient mechanical engineer, and, therefore, cannot figure out exactly the dimensions I require. The engine is to be a 6x10 inch, horizontal type. Please answer the following questions: 1. What should be the size of steam and exhaust ports? *A.*—Steam ports, ½ inch wide, 5 inches long; exhaust port, 1¼x5 inches. 2. Thickness of bridges. *A.*—⅝ inch. 3. Dimensions of valve, and its travel. *A.*—Lap, ⅝ inch; travel, 2½ inches. 4. Diameter of crank-shaft. *A.*—3 inches. 5. Size of crank-pin and crosshead pin. *A.*—Overhanging crank-pin of wrought-iron, 1½ inches diameter, 1⅞ inches long. Crosshead pin, 1 inch diameter, 1¼ inch long. 6. Number of square inches of wearing surface on crosshead. *A.*—10 square inches. 7. What should be the speed to obtain the best results? *A.*—A piston speed of 500 feet per minute. 8. What should be the diameter of the piston rod? *A.*—1⅛ inch. 9. What should be the length of the connecting rod? *A.*—30 inches.

(224) D. R., Toronto, Canada, writes: We have a pair of dies 11 inches long, 9 inches wide and 6 inches thick. The form punched is the shape of a **T**, with a curved flange. We heat them slowly, taking about 4½ hours for the purpose; we then allow them to rest in a tub, with the faces downward, on two pieces of iron, the faces being immersed in a depth of 2 inches of water, and a steady flow is kept up through a 1-inch pipe. They were then carefully examined and appeared to be all right. They were used for a short time, after which they were put in the die room, and on the twenty-fifth day one of them broke in two with a force sufficient to knock down another die weighing 175 pounds. What, in your opinion, was the cause of this? What method would you advise as the best one for hardening dies of this size? *A.*—It is difficult to give an opinion in regard to the breaking of the die without examining it, and knowing more of the manner of forging it; the cause may have been due to an unequal stress in the metal put in it during forging. We do not know of a better method of hardening than you have adopted. Care must be taken to heat to a proper temperature, such as will not require any drawing. The temperature will depend much upon the quality of the steel. We should determine the correct temperature by experimenting with a piece of the kind of steel used.

(225) H. L. S., Atlanta, Ga., writes: I send you herewith a sketch of two cotton-mill buildings; they stand at an angle of 20 degrees to each other, with the engine at right angles to one of them, as shown. The question arose among us as to whether or not the machines in the other mill could be driven by the same engine by means of rope transmission, and if so would it be practical or good engineering to do so? Some hold to one position and some to others. Please decide this question through your Question and Answer columns, and if possible give a crude sketch of the manner of giving the ropes the desired angle if it can be done practically. *A.*—It can be done, and it is practical. We should adopt the following plan: Let us designate the building in which the engine is located by the letter *A*, the other building by *B*. In building *B* erect a countershaft above or below the main line shaft, and set the former parallel to engine shaft in building *A*. With this arrangement there will be no difficulty in transmitting motion from the engine to the countershaft, and from the latter to the main line shaft; but we should prefer a separate engine for driving the machinery in building *B*. The advantage of this will be that, should it be necessary to stop the engine in one building, work will not be interfered with in the other building; and there will be no ropes exposed to injury due to the weather.

(226) A. S. E., Austin, Minn., writes: Please give me a rule for finding the resistance on the thread of the two studs for a pop valve 2¼ inches diameter; boiler pressure, 140 pounds. *A.*—The studs will be subjected to the maximum stress when the valve is blowing off steam, and this stress will depend on the lift of the valve, or, in other words, on the total compression of the spring; the latter is equal to the sum of the compression due to setting the valve for the given steam pressure, plus that due to the lift of the valve. For a valve of this size the spring is generally made of ⅜ inch square steel, its mean diameter is, say, 1.8 inches, and it has usually 6 free coils. The compression due to setting the valve for the given pressure is found by the following formula:

$$E = \frac{d^3 \times w}{30 \times D^4}, \qquad (1)$$

in which E denotes the compression of one coil in inches; d the diameter from center to center of the steel bar constituting the spring in inches; D the side of the square of the steel bar in sixteenths of an inch; and w the load applied. The area of a valve 2¼ inches diameter is 3.97 square inches; the pressure is 140 pounds per square inch, consequently the load w will be $3.97 \times 140 = 555.8$ pounds. Substituting for the symbols in formula (1) their values we have

$$E = \frac{1.8^3 \times 555.8}{30 \times 6^4} = .08.$$

This result shows that each coil will be compressed .08 of an inch in setting spring for a steam pressure of 140 pounds per square inch. The lift of the valve will probably not exceed ¼ inch; hence the compression of one coil due to the lift will be $\frac{.25}{6} = .04$ inch, and the total compression when the steam is blowing off will be $.08 + .04 = .12$ inch. For finding the load w due to this compression we have the following formula:

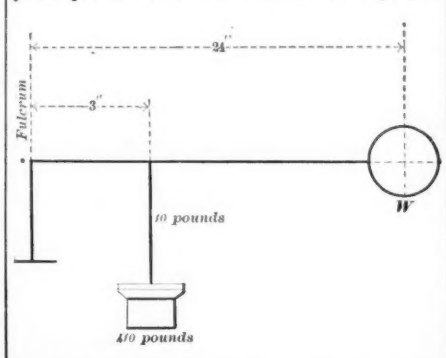
$$w = \frac{E \times D^4 \times 30}{d^3}, \qquad (2)$$

in which the symbols denote the same quantities as in formula (1). Substituting for the symbols of formula (2) we have

$$w = \frac{.12 \times 6^4 \times 30}{1.8^3} = 800 \text{ pounds.}$$

That is to say, when steam is blowing off both studs are subjected to a tensile stress of 800 pounds, or 400 pounds of tensile stress on each stud. If the stud is ⅝ diameter, we may assume the diameter at the bottom of the thread to be ½ inch; the area of this is .196 square inch; therefore the tensile stress per square inch will be $\frac{400}{.196} = 2,040$ pounds.

(227) W. H. W., New Haven, Conn., writes: In your reply to J. W. S., Question 572, in your issue of December 31, 1891, you say, "Multiply the weight of the valve and stem in pounds by the distance in inches from the fulcrum to the center of the valve." I am an unbeliever. Why multiply by anything? The valve and stem press downward to the extent of their weight, and not three or four times their weight. Is this not so? If not, why not? Do not throw this in the waste basket; but if it is not of sufficient interest to merit a reply in the paper, just send me a short explanation by mail. At the same time I trust you will not insert it unless you are ready to also put in replies (if there be any made) to what you say. *A.*—All computations relating to the equilibrium of the safety valve lever are interesting examples of the application of the moment of forces. We prefer to look at this problem in this light because it makes the solution simpler and easier to remember. We have, for instance, a force (the steam pressure on the valve) acting upward; multiplying this force by its arm, that is, the distance from the center of valve to fulcrum, we obtain the moment of this force, which for equilibrium must be equal to the moments of the forces acting in a downward direction. The forces which act downward are: 1st. That due to the weight on the end of the lever; its moment is the product of the weight into its distance from the fulcrum. 2d. The force due to the weight of the lever; its moment is the product of the weight of the lever into the distance from the fulcrum to the center of gravity of the lever. 3d. The force due to the weight of the valve and spindle; and the moment of this force is the product of the weight of valve and spindle into the distance from the fulcrum to the center of the valve. For equilibrium the last three moments must be equal to the first one. Before we answer your questions let us work an example, in



which, for simplicity, we will leave the weight of the lever out of consideration. Let the distance from the fulcrum to the center of the valve be 3 inches; weight of valve and stem, 10 pounds; total steam pressure on the valve, 410 pounds; the weight W in the illustration is to be placed 24 inches from the fulcrum. How heavy must the weight W be to balance the steam pressure? According to our rule we have $410 \times 3 = (10 \times 3) + (24 \times x)$, in which x denotes the number of pounds in the weight; this gives us

$$\begin{aligned} 1,230 &= 30 + 24x \\ &= 1,230 - 30 = 24x \\ &= 1,200 = 24x \\ &= \frac{1,200}{24} = x = 50 \text{ pounds for the} \end{aligned}$$

weight W. Now according to your method we subtract the weight of the valve and stem from the steam pressure, which gives us 400 pounds; hence for equilibrium we have

$$\begin{aligned} 400 \times 3 &= 24x \\ 1,200 &= 24x \\ \frac{1,200}{24} &= x = 50 \text{ pounds for the} \end{aligned}$$

weight W. The results of computations are the same. To make this example complete let us now take the weight of lever into account; say its weight is 15 pounds, and the distance from the fulcrum to the center of gravity is 12 inches. Then according to our rule we have

$$\begin{aligned} 410 \times 3 &= (10 \times 3) + (15 \times 12) + (24 \times x) \\ 1,230 - 30 - 180 &= 24x \\ \frac{1,020}{24} &= x = 42.5 \text{ pounds for the} \end{aligned}$$

weight W. Now to answer your first question. It is true that the valve and stem press downward to the extent of their weight; but the reason for multiplying this by 3 is that we have also multiplied the total steam pressure by 3, which you have overlooked. The example shows that either method may be used. We prefer ours, which, we believe, if once understood, will not be as liable to lead to mistakes as the other method, and is easily remembered.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant Gear Wheels, Gear Cutting, page 20.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N Y.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

A. D. Pentz, Consulting. Tools. Elizabeth, N. J.

Tool Holder: Armstrong Bros. Tool Co., Chicago.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

"The Bulldozer," a new departure; forging by pressure. M'f'd by Williams, White & Co., Moline, Ill

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N. Y.

S. A Smith 23 S. Canal St., Chicago, Ill., is agent for Holbrook's new loaded rawhide mallets.

"Boiler Tests by Barrus." Get sample pages from Gowing & Co., Mason Building, Boston, Mass.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

S. W. Card & Co., Mansfield, Mass., are putting on the market a new line of stocks and dies, with their patent adjustable dies and guide. S. A. Smith, 23 S. Canal Street, Chicago, Ill., Western Agent.

25" } "Only Drill Press built on
32" } 'Ko-rekt' principles,
37" } Even if they come from Jersey."
42" } Gould & Eberhardt, New Ark, N. J.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases.
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

Just Pub.—Safety Valves, History, Invention & Calculation. By W. B. LeVan. Fully ill. $2. Cat. of Machinists', Electricians' & Engineers' books sent free. N. W. Henley & Co., 150 Nassau St., N. Y.

We will pay 25 cents each for copies of the AMERICAN MACHINIST of December 25, 1886 issue; must be unsoiled, and in good condition. AMERICAN MACHINIST PUBLISHING COMPANY, 203 Broadway, New York.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Just Published: "Ways & Means" for Machinists & Metal Workers. A new work, thoroughly practical, containing new matter that no intelligent mechanic should miss. The cheapest work ever issued, 160 pp., 150 illustrations, including working details of the latest mach. tool design & prac. Cloth. Price $1. John W. Weston, Pub. Journal of the Association of Eng. Societies, 78 La Salle St., Chicago.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy" By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Sometime since the Postmaster-General requested that the American flag be displayed at post-offices—a very sensible thing. So far as we know, in most instances the employes have been called upon to pay for the flags. If the government wants the flags displayed, what is the matter with its furnishing them?

Rather a curious phase of shipping law is developed in the case of the Glengoil's crew. Having signed articles for a term, they forfeit their earned wages if they desert the ship, which is under charter to return to Brazilian ports. The malignity of the yellow fever now raging at Santos is such that some mail steamships have just been excused from touching there. This is an executive recognition of the fact that a call at Santos at the present time is not a reasonable requirement to impose on a human being. Yet if Jack declines to commit self-murder by an act which has become an unreasonable one since he engaged to perform it, he is mulcted by forfeiture of wages already earned—which seems to prove several things, of which one, perhaps, is that since he is only a Jack Tar it serves him right.—*Evening Sun.*

The eight days' argument in the electric light case in the United States Circuit Court of Appeals is over, and the judge will soon begin the weary task of considering the miscalled "briefs" of the opposing lawyers. Matters in this country are not, perhaps, so bad as in England, but some of the criticisms of the English judges of the delays and expense of patent causes might be repeated here. Could not some United States judge copy the words recently uttered by a high judicial officer of England, who said in a published opinion: "It seems to me that there is something catching in a patent case, which makes everybody argue and ask questions to an interminable extent. A patent case, with no more difficulty than any other case, instead of lasting six hours, is invariably made to last six days, if not twelve. The moment there is a patent case, one can see it before the case is opened or called in the list. How can we see it? We can see it by a pile of books as high as this," holding up the paper, "invariably, one set for each counsel, one set for each judge, and by the voluminous shorthand notes; we know here is a patent case. Now, what is the result of all this? Why, that a man had better have his patent infringed, or have anything happen to him in this world short of losing all his family by influenza, rather than have a dispute about a patent." The experience of many

American inventors shows that there would be no exaggeration in similar expressions concerning American patent law.—*New York Tribune.*

Pattern Making.

By P. S. Dingey.

IV.

GOVERNOR VALVES.

The two sections in Figs. 15 and 16 represent a valve that is not only used on governors, but is very often used in water tanks to regulate the supply of water, a hollow ball that floats being attached to the valve lever in the usual way.

In Fig. 15 the rotating valve *a* is shown in place with the two passages almost wide open, but in Fig. 16, which is a section of Fig. 15, through *A B*, the valve is removed, and is represented in Fig. 17.

There are ways of making the pattern and core boxes for this style of valve other than are given here, but the method represented by the illustrations has been chosen because it is the way the writer would adopt.

Fig. 18 is the pattern which is parted on line *C D*, or, in other words, the joint of the pattern is the same as the outline of the section, Fig. 15. There is nothing to prevent the pattern from being parted on line *A B*, that is, as Fig 16 shows, but this would necessitate setting the cores in the mold in not quite so good a way as they can be, by parting the pattern on *C D*, and molding it as represented in Fig. 18. Not much of this pattern can be turned in the lathe, but the flanges, prints, and a small part of the inlet and outlet, therefore the part which surrounds the valve chamber, will have to be worked off by hand.

The flanges are inserted in a groove in the same manner as shown in the AMERICAN MACHINIST of May 5, in an article on plug valves.

Figs. 19 and 20 are two views of the core box for valve chamber *c* and outlet *b* in Figs. 15 and 16, while Figs. 21 and 22 are two views of the box for the inlet *d*, and the space *e* outside the valve chamber.

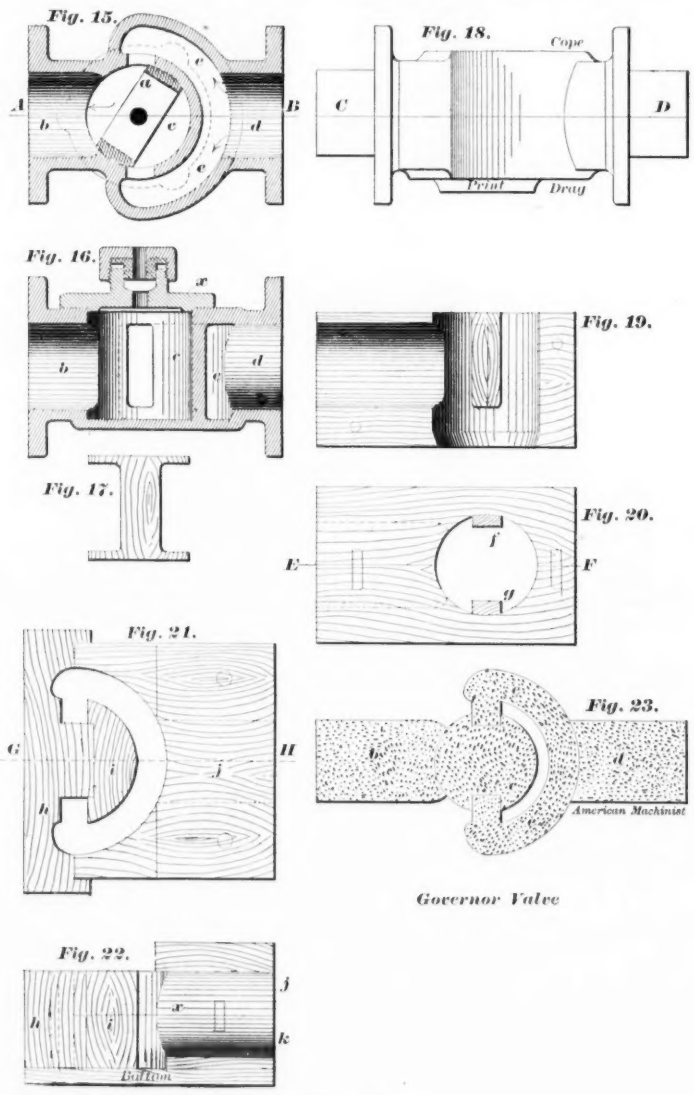
The core box for *b c* is shown parted in Fig 20 on line *E F*, Fig. 19 being a view of the joint on the face; *f g* are core prints for the ports. Cores from this box need not be made in halves and pasted together in the ordinary way, as they can be made whole and dried easily otherwise.

The box in Figs. 21 and 22 is not so plain as the one just mentioned, though it is by no means a difficult box to make. By examining the two views of this box, it will be found that it is made in four parts—*h, i, j, k;* if the bottom be counted it will make five. Fig. 22 is a section of Fig. 21 on line *G H*—the joint line *x* in Fig. 22 shows the two pieces *j* and *k* parted and doweled together; *h* fits over the ends of *j k*, while the circular part *i* is made loose from *h*. This core also can be made whole, pasting being dispensed with.

When ramming up this core, the top side of the box will be Fig. 21; after it is rammed up, part *j* is taken off and a plate laid on top of the core, and the remaining parts of the box with the core are turned over on this plate. The bottom is then taken away, *i* drawn up, and *h* drawn away sidewise. Nothing now remains but to take off *k*, when the core will be left standing on the plate, on which it can be dried.

In Fig. 23, the two cores made from these two boxes are shown connected, the two prints *f g* having formed a seat in *b c* for *d e* to rest in. In Fig 19 the prints are carried flush with the top of the box, but the ports are only wanted the length indicated by arrow points. This is to allow core *d e* to be set into the core *b c*, after which small pieces of cores are nailed or pasted into the upper parts of the slots which have not been filled by *d e*.

The dotted lines in Fig. 15 represent the bonnet *x* in Fig. 16, but as this, with the other details, are plain and simple patterns to make, it will be out of place to fill valuable space with a description how to make them.



Governor Valve

PATTERN MAKING.

Picked Up in the Shops.

By Fred Herbert Colvin.

We hear considerable talk every summer about the Saturday half-holiday movement, and there is an ever-increasing tendency to close places of business on Saturday afternoons, principally stores and offices. That the additional holiday is desirable few will deny, and the pessimistic cry that it affords more time for dissipation need not be noticed; the mass of work people are not inclined that way.

That some do seize this (as every opportunity) for a season of dissipation is no argument against the holiday. The same can be said about Sunday or any holiday, either national or religious. There is a side to the question that receives little or no attention, and the only one that can be considered as harmful, if there is any harm in the system. In many places, most places, in fact, the employes "make up" part, if not all of the time, that they receive Saturday afternoon, some by beginning before the usual time in the morning and by taking shorter nooning, or by working later at night; any or all of these are usually required to get the "half-holiday." Of course it is not reasonable to expect the employers to give all of the time to the working people, and, on the other hand, very few feel able to lose the wages for that time, so it will be asked, What other method is there to pursue?

Unless there can be a compromise effected (and this seems to be the true solution of all reasonable demands made by either side) there is perhaps no other way, and the writer would be the last to disturb the existing order as long as it is satisfactory to all concerned. There is a side of the question yet to be considered.

What is the effect of this overwork for five days (or five and a half, usually) on the workers? They work overtime five days to gain a rest on the sixth, and exert themselves more than usual each day to gain the time at the end of the week.

Then the half-holiday is very often spent in "going somewhere," it does not matter much where, as long as they are on the go, stimulated by the excitement of being out of the shop or factory. This over-exertion occurs at the worst possible time of the year—the heated months—and it would be strange indeed if the effect was not in some degree harmful. I have heard complaints about feeling "so tired" Monday, and some seem to take the rest of the week to get rested in; does it not seem as though there should be a better distribution of the working hours?

We are told by all reliable physicians that regularity in all things is desirable, and nature seems to bear out the assertion. Looking at the question from this standpoint, the unequal working hours are not desirable, and the extra exertion required to "make up time lost" may be more injurious in the end than the regular hours every day.

There is another question to be looked at in considering this: Would it not be better for the half-holiday rest to come in the middle of the week?—to make, as it were, a half-way house for a little rest before finishing the labors of the week. This would be objected to by many as depriving them of the opportunity to "go somewhere," as they go Saturday afternoon and come home any time before Monday at 7 A. M. But is not this very objection a point in its favor?

It would prevent, it is true, the trips around the country surrounding—trips that are pleasant and enjoyable, but which are often consumers of energy that might better be reserved for future use. This very preventive might have a good effect, by preventing, in a measure, the excesses that are such a drain upon nature. The excessive physical or mental strains might be lightened by the necessity of taking short trips, or of staying near home and resting themselves for the coming work of the morrow. There is one feature of this plan that does not strike my fancy, and that is the partly compulsory abstaining from excesses; for, as history proves pretty clearly, this form of improving the world has never been successful.

Education must teach moderation in all things, as well as teach the higher branches of mathematics and chemistry, and no law can ever be enforced that will attain the desired end. Education is slow in progress, but to that must we look for the solution of the problem. It is not likely that this plan of having the half-holiday in the middle of the week will find many supporters; the great majority prefer the time all together, but it certainly seems more in accord with nature's plans to distribute the time so as to rest twice a week, thus lessening the fatigue that accumulates between the periods of rest.

It is surprising to see the indifference, often amounting to carelessness, that is exhibited by men working around belting moving so swiftly that it could not be stopped in time to save a life if the workman should become entangled, and so powerful as to crush a body with comparative ease. The old saying concerning "familiarity and contempt" is borne out in this case; yet we seldom hear of any one getting caught. A few precautions are necessary before working around belting, the observance of which makes it much less dangerous. We see men going up the ladder to throw a belt on or off, and notice that their jumper or shirt, or whatever they wear, has several loose ends hanging to it—good "feelers" for the belt to get acquainted with. This is careless in the extreme, and the careful man always sees that there are no inviting ends hanging loose when he goes to attend a job of this kind The careful man rolls up his sleeves, if they are loose, and either takes his apron off, or rolls that up carefully, and fastens it so it cannot become unfastened, then he is ready for business It does not take long to observe these precautions, and it pays compound interest. He does not grip the belt he is to throw on as he would an old acquaintance, does not give it a real hearty hand-shake, but holds it over the thick part of his thumb, leaving that useful member outside, as it does not belong between the belt and pulley, and is in the way for the purpose of a roller. With the belt held as described, and no part of the hand where it can possibly be drawn under the belt, it is comparatively safe to throw any ordinary sized belt without any appliances for the purpose.

Belts up to 6″ can be handled quite easily, over pulley up to 24″ and running at speeds up to 1,200 or 1,400 feet per minute; anything over this had better be provided for by some mechanical appliance that is safer and more efficient.

It is getting time to consider the problem of keeping the shop cool enough for comfort for all hands. This can best be obtained in most cases by the use of fans suspended from the ceiling; they are not expensive, and give a good circulation of air if run at the right speed, which, of course, varies with the different applications. In low rooms they should not be run as fast as in cases where the fans are far above the head. In the first case, the air is blown direct on the workmen, too often resulting in a severe cold. Where the ceiling is high the air is diffused before it reaches the men, and they can be run much faster than in the case of a low ceiling. For a ceiling 12 to 15 feet in height, and fans having about a three-foot blade (six feet from tip to tip) it has been found good practice to run them at from 150 to 200 revolutions per minute.

This gives very good results, and does not take as much power as might be supposed. One instance in the writer's knowledge gave results that probably will not be duplicated in every-day practice: Twenty-one fans were run at a speed of 120 turns per minute, together with over a hundred feet of shafting, driven by an inch and a half belt running 500 feet per minute. The power can be calculated to suit the individual, using the constant that he has found best in practice.

The gunboat Castine, recently launched at Bath, Maine, is 190 feet long on the water line, 32 feet breadth of beam, and draws 12 feet of water. She has triple expansion engines, twin screws, and locomotive boilers.

The builders are to receive $5,000 for each quarter of a knot over 13, and forfeit a like sum for each quarter of a knot below that number.

MANUFACTURES

The Campbell Frog Works, at Bucyrus, O., are to be enlarged.

The Malden (Mass.) Electric Company will enlarge its plant.

J. O. Alger will enlarge his foundry plant at Cohasset, Mass.

A carbon plant will be established at Fremont Ohio, probably.

More machinery is to be put in by W. H. Cooper, Parkersburg, W. Va.

The Illinois Nail Company, Chicago, Ill., has been capitalized at $50,000.

The American Electrical Co. has been incorporated at Portland, Me.

The Fay & Scott machine tool plant at Dexter Me., will be enlarged.

The electric light and power plant at Middletown, N. Y., will be enlarged.

H. J. Davis will erect a foundry and machine shop at Goodwater, Ala.

The Vulcan Foundry Company has just been organized in Providence, W. Va.

A new machine shop, to employ twenty men, will soon be started in Dexter, Me.

The Yale Cyclometer Company is a new $2,000 concern at New Haven, Conn.

Iron Mountain, Mich., expects soon to have a foundry and other new works.

E. Crawley contemplates enlarging his bookbinding machine works at Covington, Ky.

The Seaboard & Air Line Railroad is preparing to erect large repair shops at Elberton, Ga.

B. P. Shelor is preparing to erect a bolt and machine screw factory at Elliston, Va.

Additional machinery is being put in the mill of the Morgan Iron Works at Spartanburg, S. C.

The American Car Company will erect a shop 150x300 feet, at St. Louis, Mo., at a cost of $12,000.

The Atlas Foundry Company is a new $4,000 concern in Chicago, Ill. W. J. Brett is an incorporator.

The Suburban Electric Light Company is to make improvements about its plant at Elizabeth, N. J.

We understand that the plant of the Union Foundry and Machine Works of Frederick, Md., will be enlarged.

The Lewiston Foundry and Machine Co., of Mifflin County, Pa., has been organized, with a capital of $20,000.

The boiler shops of the Michigan Iron Works at Cadillac, Mich., which were destroyed by fire recently, will be rebuilt.

The Crane Machine Company has leased the machine shops in Shepherdstown, W. Va., and will put them in operation soon.

The Lehigh Valley Spring Works, Limited, of Lehighton, Pa., has moved a portion of its Anniston (Ala.) plant to Cumberland, Md.

The muck department of the old Ironton Rolling-mill, Ironton, O., has been put into operation by the Eagle Iron and Steel Company.

The Lukenstein Steel Co., of Coatesville, Pa., recently started to make its own steel, it having put in six new open hearth steel furnaces.

The Alexander Foundry and Machine Shop, at Alexandria, La., will be greatly enlarged, and a number of new machines will be put in.

The Norrish Foundry and Machine Company, of Glen Rock, York County, Pa., which recently removed from Harrisburg, has doubled the size of its plant.

The Warwick Iron Company, of Pottstown, Pa., has been incorporated, with a capital of $260,000, for the purpose of manufacturing pig and malleable iron.

The Colonial Mining Company, capital stock, $300,000, has been organized at Portland, Maine, for the purpose of manufacturing and dealing in mining machinery.

The Dexter Machine Company, which two years ago removed from Dexter to Providence, R. I., has decided to return to Maine and occupy their old plant at Dexter, Me.

W. D. Forbes & Co., Hoboken, N. J., have added a blacksmith shop and a steam hammer to their plant. In addition to their regular work they will do forging of all kinds.

The new electric plant of the Baltimore & Ohio R. R., Pittsburgh, Pa., will be in operation in about a month's time. Five dynamos will supply 105 arc and 500 incandescent lamps.

The newly incorporated Beacon Cycle Manufacturing Co. has come into possession of the plant of the defunct M. V. Livingston Cycle Co., at Westboro, Mass., and will operate it.

The Acme Car Coupler Company, of Pittsburgh, with a capital stock of $25,000, were granted a charter last week. The directors are G. P. Krauth, Henry McCoy and Edward M. Grove.

Coates & Co.'s tin plate-mill, Baltimore, Md., has begun the manufacture of tin-plate, employing 250 men. The output will be from 1,500 to 1,800 boxes a week, an average of 110 pounds each.

The Crescent Firearms Co., of Norwich, Conn., lately organized for the manufacture of guns and rifles, has leased room and power in the new building of the Norwich Industrial Building Co.

The Kenwood Bridge Company, of Chicago, have secured the contract for the new train shed to be built by the Illinois Central Railroad at New Orleans. There will be 300 tons of iron and steel in this shed.

The preliminary arrangements have about been completed between Evell Eastman, of Birmingham, Ala., and the Improvement and Furnace Company, of Llano, Texas, for the erection of a 60-ton iron furnace at Llano.

The Shipman Automatic Freight Car Coupler Company, of Kishwaukee, Ill., has been granted license to incorporate, for the manufacture of car couplers. F. C. Johnson, R. A. Shipman and others are the incorporators.

The Duvall Engine Works, which were removed to Roanoke, Va., from Zanesville, O., are about ready to begin the manufacture of machinery, builders' iron and castings. They will give employment to 100 men at the start.

The Conners Manufacturing Company has organized, at Columbus, O.; capital, $2?,000. It will occupy the old Stevenson foundry, and will engage in the manufacture of engines and boilers, and other mechanical appliances.

J. H. Horne & Sons' Company, of Lawrence, Mass., have decided to build a new machine shop, 64 feet wide by 107 feet long, and have placed the contract for its erection with the Berlin Iron Bridge Company, of East Berlin, Conn.

The plant of the Katahdin Iron Works, near Bangor, Maine, has been sold to the Pictou Charcoal Iron Company, of Pictou, N. S., and the machinery and equipment is being removed to that place. It had been idle since 1890.

The Eclipse Tool Company has been incorporated, with a capital of $30,000, at Chicago, Ill., to manufacture and sell tools, hardware and other merchandise. Incorporators: Albert Billingslea, J. Leroy Francis, Wm. S. Gooding.

John H. Leathers, of Louisville, Ky., who is largely interested in the North Alabama Furnace, at Florence, Ala., recently inspected the plant, and has decided to put more money in the enterprise and put the works in operation.

A charter has been granted to the Bessemer Iron, Mining and Manufacturing Company, at Galveston, Tex., with $1,000,000 capital. R. W. Campbell, of Galveston, and others are the incorporators. The company will erect furnaces and rolling-mills.

The Seyboid Machine Company, of Cincinnati, have purchased from Carnegie, Phipps & Co., the Columbia Bridge Works, located at Dayton, Ohio, and will at once improve the property, equip it with new and modern machinery, and permanently locate at that place.

The Smith-Hill Foundry and Machine Company, Quincy, Ill., are erecting a large addition to their present machine shop. The addition will be 100x50 feet, two stories and basement. The company will also add the most improved machinery adapted to their line of business.

The Southwestern Bridge Company, of Little Rock, Ark., have located an office at Rockdale, Tex., and will erect a works there, but as yet no definite action has been taken. The company builds a patented bridge which is rendered self-supporting by endless steel cables.

The Chihuahua Iron Works, Chihuahua, Mexico, are about to erect a new plant. It will consist of eleven puddling furnaces, two scrap furnaces, two heating furnaces, twenty-five nail machines, one 22-inch and one 12-inch mill, and one squeezer. Two hundred men, principally Mexicans, will be employed.

There is water-works agitation in Ottawa, Ill.; La Grange, Ga.; Darien, Ga.; Sinclairville, N. Y.; Bryan, O.; Bridgeport, Conn.; Houston, Tex; Whatcom, Wash.; Middletown, N. Y.; Danville, Va.; West Milton, O; Wyth City, Ala.; Goffstown, N. H.; Liberty, N. Y; Walden, N. Y.; Charter Oak, Ia.; Walton, N. Y.

Chandler & Taylor Co., Indianapolis, Ind., have brought out a new double engine, which they believe will find favor with their customers. It is made with or without link motion, and for various purposes. The company has recently furnished one of these engines to operate a switchback railway in Chicago.

The Jenne Compound Rail Co. has been formed in New York City. The amount of capital stock is placed at $3,000,000. The company will deal in railway rails, spikes, bolts, etc. The stockholders are J. A. George, of Woodhaven, N. Y.; N. S. Kellogg, J. H. Costello, J. H. Cain, of Brooklyn; and George Smallwood, of New York City.

Car shops are to be built at Depew, N. Y., for the N. Y. C. & H. R. R. Co. They will cost over $600,000 and are to be completed by October next. The shops will employ 1,500 men in the repair and manufacture of locomotives for the Vanderbilt lines. Their capacity will be 48 locomotives, all to be under construction at the same time.

J. J. Larzalere, lately carrying on business at Muncy, Pa., has removed to Williamsport, Pa., and in conjunction with his son has there embarked in business under the title of Larzalere & Son, as dealers in new and second hand engines, boilers, saw-mills, shafting, feed mills, etc. They contemplate shortly erecting an engine plant, and will commence manufacturing.

The Brown, Bonnell Iron Company, of Youngstown, Ohio, have been granted a charter of incorporation, with a capital stock of $1,200,000, for the purpose of engaging in the manufacture of iron, steel, and articles composed of such material, mining coal, iron ore, etc. The incorporators are Henry Tod, Chas. C. Baldwin, Jno. I. Williams, Robert McCurdy and Cecil D. Hine.

The Ball & Wood Co., 15 Cortlandt street, New York, ever since the shipment of their first improved Ball high-speed engine in October last have been running twenty-four hours each day to keep up with their orders, and now have between twenty and thirty engines on the floor under construction, all contracted for. Important additions to their works are under contemplation. Among their recent shipments are the following: Two 300 H. P. cross compound engines for the Brush Electric Co., Cleveland, O.; two 125 H. P. engines for the Yonkers Street Railway Co., Yonkers, N. Y.; one 100 H. P. engine for the Pennsylvania Railroad Co., Baltimore, Md.; one 150 H. P. engine for the Tide Water Oil Co., Bayonne, N. J.; two 300 H. P. cross compound engines for the Sauquoit Silk Mfg. Co., Scranton, Pa.; one 300 H. P. cross compound engine for the Edison Electric Illuminating Co., Paterson, N. J.; three 150 H. P. Standard engines for the Edison Electric Illuminating Co., Paterson, N. J.; one 150 H. P. engine for the State House, Trenton, N. J.; one 100 H. P. engine for the Meriden Electric Light Co., Meriden, Conn.; two 80 H. P. for the Four Seasons Hotel, Cumberland Gap, Tenn.; one 150 H. P. for the Laconia Car Co., Laconia, N. H.; two 150 H. P. engines for the Chicago Arc Light and Power Co., Chicago, Ill.; one 100 H.P. engine for Sulzer Brothers, Winterthur, Switzerland; one 60 H. P. engine for the U. S. Navy Yard, Brooklyn, N. Y.

Machinists' Supplies and Iron.

NEW YORK, May 14, 1892.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $15.75 to $16; No. 2, $14.75 to $15; Gray Forge, $13.75 to $14. Southern brands of good quality are obtainable at $15 to $15.50 for No. 1 Foundry; $14.25 to $15 for No. 2; and $13 to 13.50 for Gray Forge.

Scotch Pig—Coltness is quoted at $21; and $20.25 for Eglington.

Antimony—The market is steady.

We quote Hallett's, 11⅞c. to 11½c.; Cookson's, 14½c. to 15c.; and L. X., 13c. to 13¼c.

Copper—The local market for Lake Copper remains nominal at 12¼c. asked for car loads. Casting Copper is quoted at 11.25c. to 11.40c., according to quantity.

Lead—Some business has been done at 4.20c. to 4.25c. for 50-ton lots, but it is claimed that these sales were made for speculative purposes by second hands, to influence the market.

Lard Oil—The market is firm at 56c. to 57c. for Prime City. Western on spot is quoted at 55c. to 56c.

Spelter—The reported flooding of mines in the West has advanced prices. Smelters' views have become stronger; they are asking 4.80c. to 4.30c. for prompt New York delivery, but there is no demand to make a market price.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. Seven words make a line, and the address as desired to appear should be included. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—A man with small capital to operate foundry. Address J., AMERICAN MACHINIST.

Wanted—A position as foreman of boiler shop; good reference. Address G., AM. MACHINIST.

Wanted—A good well-tool blacksmith. Apply to F. F. Collins Mfg. Co., San Antonio, Texas.

Wanted—Good floor and vise men. Sioux City Engine Works, Sioux City, Iowa.

Wanted—Superintendent with $3,000 to take charge of shop where hoisting machinery is a specialty. W. R. C., AMERICAN MACHINIST.

Wanted, at once, three good machinists; long time job; light class work; two hours' ride from Chicago. BOX 2, AMERICAN MACHINIST.

Wanted—Brass and bronze molders; none but sober men. Apply to Norwich Lock Mfg. Co., Roanoke, Va.

A practical hustling foreman boiler maker, with even temper, pleasant disposition and strictly sober, is open for engagement; can handle men and machinery. Address Foreman, AM. MACHINIST.

Wanted—Foreman for boiler shop, one who thoroughly understands the business. None but first-class need apply. Steady work. Give reference. S. V. Machine Co., Louisville, Ky.

Position, by a mechanical engineer who has occupied position in two manufacturing companies during past 15 years as designer, superintendent, traveler and manager. Address W. N. S., AM. MACH.

Engineer and draftsman experienced in the designing of machine tools and machinery in general with experience here and abroad, desires suitable position. Address N. N., care AM. MACHINIST.

Mech. draftsman and engineer of practical ability desires an engagement where the steady services of a faithful and competent young man are wanted, exper'd on mach. tools, cable driving mach'y, gen. engineering, etc.; excellent refs. A. J., AM MACH.

Wanted—Foundrymen to know they can secure a foreman who is practical and experienced in gen. foundry work and can produce first-class work by modern methods. For particulars and references address Modern Methods, AMERICAN MACHINIST.

Wanted Situation—By foreman molder experienced in heavy and light machinery work, core work, etc.; can work men to advantage; would buy an interest if satisfactory; references. Address N. R. G., care AMERICAN MACHINIST.

Wanted—Position by tool maker thoroughly acquainted with screw machine work; capable of designing tools to turn out good work at low cost; New York or vicinity preferred. Address Good Work, care AMERICAN MACHINIST.

PURE FEED-WATER For Steam Boilers.

THE BUNNELL FILTER AND PROCESS

Furnishes Steam Boilers with water that is absolutely freed from all scale producing substances. Guaranteed or no sale.

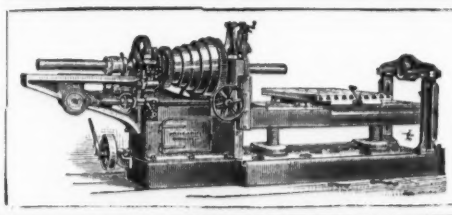
BRADLEY & COMPANY, SYRACUSE, N. Y.

POPULAR AND INSTRUCTIVE BOOKS
FOR ENGINEERS AND FIREMEN.
By STEPHEN ROPER, Engineer.
Embracing all branches of Steam Engineering. They are the only books of the kind ever published in this country, and are so plain that any engineer or fireman can easily understand them.
Descriptive Catalogue Mailed Free.
EDWARD MEEKS, Publisher,
No 1012 Walnut St., PHILADELPHIA, PA.

VALVE GEARS
FOR STEAM ENGINES.
By PROF. CECIL H. PEABODY.
8vo. Cloth, $2.50. 33 Folding Plates.
JOHN WILEY & SONS, NEW YORK.

World's Fair Exhibitors ATTENTION.
Do you desire the services of a reliable company to receive, install and superintend your exhibit during the World's Columbian Exposition? We can save you money. Unexceptional references. Write for pamphlet and particulars.
CHICAGO COMMERCIAL COMPANY,
501, 502, 503 Home Insurance Bldg., Chicago.

FOR SALE.
The entire plant of the Alex. K. Rarig Company—engineers, contractors, founders, machinists and boiler-makers. Buena Vista, Va., June 16, 1892, at public auction. If interested, write for particulars.
J. E. MULLEN, Trustee, Buena Vista, Va.

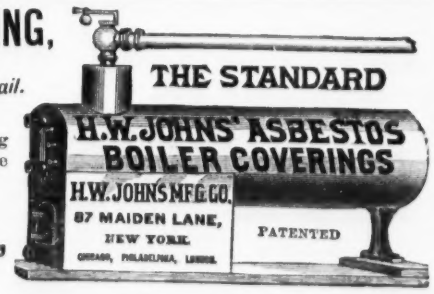


BETTS MACHINE CO.,
WILMINGTON, DEL.
MACHINE TOOL BUILDERS,
IMPROVED PATTERNS! LATE DESIGNS!

ASBESTOS CEMENT FELTING,
FOR LAGGING LOCOMOTIVE BOILERS.
Samples and Descriptive Price List Free by Mail.

We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.

H. W. JOHNS MANUFACTURING CO.,
87 Maiden Lane, NEW YORK.



A practical pattern maker of 20 years' experience, two years as foreman, doing all kind of engine and gear work, is open for engagement as foreman of some large shop; can estimate successfully, handle men to advantage, and give best of reference. Box 1, AMERICAN MACHINIST.

M. E., now holding mechanical supt's position in eng. works, would like similar position with a live, progressive company; well up in eng. work, simple and compound; also in special tool and jig; is a thorough mechanic. Address S. A. J., AMERICAN MACHINIST.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd-lathes & planers. S. M. York, Clev'd, O.

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

Best Crank Shaper $225. Am. Tool Wks., Clev., O.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Special machinery designed and built. C. F. Langston & Co., 70 N. 4th St., Philadelphia.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Complete mach'y for mfg. horseshoes delivered by L. Ingermann, Minden, Westphalia, Germany.

Stolpe's Universal Punch is new and the best; write for circular. Stolpe, 154 W. 27th St., N. Y.

Design & superintendence of mach'y. Drawings, etc., made. Claud Mantle, 598 E. 134th St., N. Y.

Wanted—Every machinist to send for bargain list of tools. E. G. Smith, Columbia, Pa.

For Sale—Machine shop and foundry, and one-half interest in a good water-power. Address Ed. Biddle, Dallas, Polk Co., Oregon.

Wanted—Hardware specialties to build. Send 25 cents for "Eureka Knife and Shears Sharpener." W. A. Smith & Co., 227 Eddy Street, Providence, R. I.

Bound volumes for 1891. We are now prepared to take orders. Price, $4.00 per volume; express charges payable by purchaser. Address AMERICAN MACHINIST, 203 Broadway, New York.

Sale of American Patent. Peter Heintz, Ludwigshafer a. Rh. The simplest and best file-cutting machine in the world. The best investment for capital. High profits. Will be sold under favorable conditions by Peter Heintz, Ludwigshafer a. Rh. Bayer, Pfalz.

The principal of a firm of British engineers who are the patentees and makers of a first-class Gas Engine expects to be in New York from the 21st to 27th May, when he would be pleased to meet or hear from any firm who are prepared to arrange for the manufacture of the same. Gas Engine. AMERICAN MACHINIST.

Machine Tools in Stock.

ENGINE LATHES.

82 in. swing, 34 ft. bed.					Whittier
78 do	9 ft. between centers				Sellers
38 do	17 ft. bed.	New			Fifield
30 do	14 do	do			do
27 do	16 do	do			
24 do	12 do	do			Fifield
24 do	12 do	do			Fitchburg
24 do	13 do	do			Flather
22 do	10 do	New Pattern			Fifield
22 do	12 do	do			do
22 do	12 do	New			Blaisdell
22 do	8 do	do			Flather
22 do	10 do	do			do
20 do	8 do	do			do
20 do	10 do	do			do
18 do	8 do	do			do
18 do	10 do	do			do
18 do	8 do	do			Blaisdell
18 do	16 do	do			do
16 do	6 do	do			Flather
16 do	6 do	do			Blaisdell
15 do	6 do	do			Flather
14 do	6 do	do			do
14 do	6 do	do			Blaisdell
12 do	6 do	do			do

PLANERS.

42 in. wide, 42 in. high, 12 ft. long, 2 heads				Gleason
36 do	36 do	8 do		Pease
30 do	30 do	8 do		do
30 do	30 do	8 do		Whitcomb
30 do	30 do	8 do		Flather
26 do	26 do	6 do		do
24 do	24 do	6 do		do
24 do	24 do	6 do		Whitcomb
22 do	22 do	5 do		do
22 do	22 do	6 do		Flather

SHAPERS.

12, 16, 20 and 24 inch stroke	Eberhardt
15 and 24 inch stroke	Hendey
32 inch stroke with key-seating attach.	Walcott

UPRIGHT DRILLS.

20, 21, 25, 28, 30 and 36 inch swing	Prentice
20, 23, 25, 28 and 34 inch swing	Blaisdell
60 inch swing Radial Drill	Baush

HILL, CLARKE & CO.,
156 OLIVER ST., BOSTON, MASS.

FOR SALE.
NEW AND SECOND-HAND
METAL-WORKING
MACHINERY
Send for list of same for immediate delivery.
WANTED TO PURCHASE FOR CASH
SECOND-HAND
METAL-WORKING MACHINERY.
GEO. PLACE MACHINE CO.,
120 Broadway, New York.

STEEL TUBES
WELDLESS
SMOOTH · COLD DRAWN
John S. Leng's Son & Co. New York.

WATCH THIS SPACE

We have added to our already extensive Warerooms a large department for **Second-Hand Machinery,** and will have constantly on hand a large stock of **Good Tools** for quick delivery.

SPECIAL INDUCEMENTS
—IN—
SECOND-HAND MACHINERY.

ENGINE LATHES.

14 in. x 6 ft. Bogert, H. S., Elevating Rest, Chuck fitted.	A1 condition.
15 in. x 5 ft. Flundel, Elevating Rest, 2 Chucks, fitted.	Good order.
14 in. x 6 ft. Windsor, H. S., Elevating Rest, 2 Chucks.	Good as new.
10 in. x 5 ft. Reed, H. S., Elevating Rest, Chuck fitted.	" "

PLANERS.

22 in. x 22 in. x 5 ft. Pease, with 12 in. Chuck.	Good as new.
22 in. x 22 in. x 5 ft. Whitcomb, complete.	" "
19 in. x 17 in. x 5 ft. Whitcomb, "	A1 condition.

DRILLS.

2 20 in. Davis, Wheel Feed, Quick Return.	Good order.
1 W. & R. 4-Spindle Sensitive Drill.	A1 condition.
1 No. 2, 3-Spindle Garvin Elevating Table.	" "
1 No. 4, 6-Spindle Garvin " "	" "

MISCELLANEOUS.

2 No. 1 Brown & Sharpe Plain Millers complete.	A1 condition.
1 No. 1 Garvin Miller, Rack Feed, not B. G.	" "
1 No. 3 Cincinnati Universal Miller, Rack Cutting Attachment, Lot of Tools, very complete.	Good as new.
1 Single Spindle Garvin Profiler.	" "
1 12 in. Juengst Crank Shaper, complete.	A1 condition.
1 No. 2 Brown & Sharpe Screw Machine and Tools.	" "
1 Jones & Lamson Lettering Machine	Good as new.
1 15 in. x 5 ft. Am. Tool & Machine Co.'s Fox Lathe, Square Arbor, Comp. Slide Rest, complete.	" "

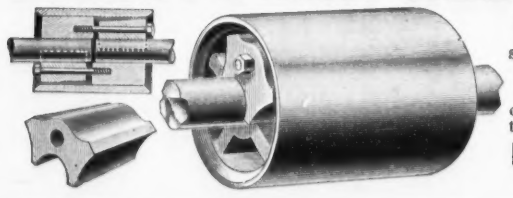
Write for list of over 350 new and second-hand tools in stock, for immediate delivery.

THE GARVIN MACHINE COMPANY,
LAIGHT & CANAL STS., NEW YORK

JESSOP'S STEEL
FOR TOOLS, DRILLS, DIES, &c.
ALL KINDS IN STOCK.
Manufactory, SHEFFIELD, ENG.
Chief Am. office, 91 JOHN ST., N. Y.
WM. JESSOP & SONS, LD.

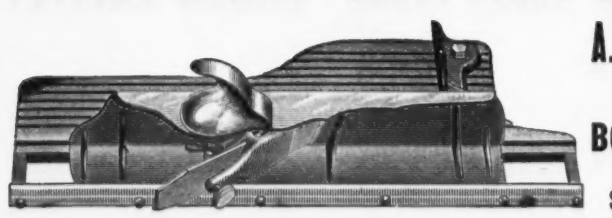
FACTORY ROOMS WITH POWER.
Three large halls, each 50x225.
Two halls, 7000 square feet each.
Steam power and heat.
City water; Gas; Cheap freighting.
Easy traction; Steam freight elevator.
Shethar Factory, Elm Street, Yonkers, N. Y.
Apply on premises, or to
T. ASTLEY ATKINS,
140 Nassau St., N. Y. City.

STUART'S PATENT WEDGE COUPLING.

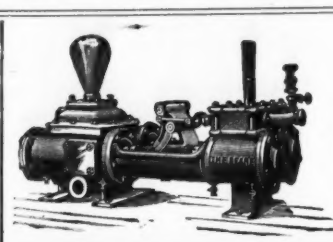


Uses Neither PINS nor KEYS.
Can be attached or removed in a few seconds without injury to shaft or coupling.
SIMPLEST and BEST in MARKET.
Also the Cheapest. 2-inch, only $4.50; other sizes in proportion. Send for Illustrated Price List of 20 sizes.
ROBERT J. STUART,
NEW HAMBURGH, N. Y.

PATTERN MAKERS' SHOOT PLANE & JACK BOARD.

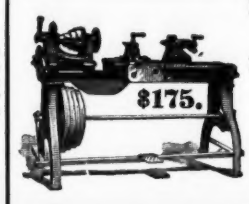


A. J. WILKINSON & CO.
Box 3600.
BOSTON, MASS.
SEND FOR CIRCULAR.



THE DEANE
OF HOLYOKE
STEAM PUMPS
DEANE STEAM PUMP CO.,
HOLYOKE, MASS.

MAKERS OF
CRESCENT STEEL CO'S
PITTSBURGH. CHICAGO. NEW YORK.
FORGINGS OF FINE STEEL
SUCH AS JEWELERS' AND SILVERSMITH'S ROLLS, DIE BLOCKS AND MILLING CUTTER BLANKS.
Also Lathe Spindles, Crank Pins, Collars, &c.

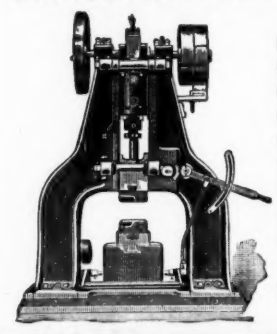


Improved Screw Cutting Foot and Power.
LATHES
Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.
THE SEBASTIAN-MAY CO.,
167 to 175 Highland Avenue, SIDNEY, OHIO.
MONTGOMERY & CO., 105 Fulton St., New York, Gen'l Agents.

SOMETHING NEW.—GALLOWAY'S LIGHTNING DIE STOCK FOR PIPE.
HANDY, STRONG,

and DURABLE.
Manufactured by **WILEY & RUSSELL MFG. CO.,** GREENFIELD, MASS.
SEND FOR NEW CATALOGUE.

A LONG FELT WANT SUPPLIED.



A Power Hammer that is Controllable, Efficient and Durable.
TAKES THE MINIMUM OF POWER AND GIVES THE MAXIMUM OF EFFICIENCY.
The operator can control perfectly the force of the first or any succeeding blow and stop the hammer instantly.
FOR CATALOGUES AND PRICES ADDRESS
THE HACKNEY HAMMER CO.
Johnson Street, - CLEVELAND, OHIO.

R. MUSHET'S SPECIAL and TITANIC STEELS.
How to get the best results with "R. MUSHET'S SPECIAL STEEL." Greatly increase your speeds and feeds; then compare the work you turn off with that done by any other known Steel. This will make the first cost of "Mushet's" look insignificant.
B. M. JONES & CO.,
Sole Representatives in the United States.
11 & 13 Oliver St., BOSTON, MASS.
143 Liberty St., NEW YORK.

VANDERBEEK'S
NEW COUNTERSHAFTS.
NEW CONSTRUCTION,
NEW FRICTION AND SELF-OILING
THROUGHOUT.
THE STATES MACHINE CO.,
HARTFORD, CONN.

FOR SALE CHEAP.
Factory and building, including two and one-half acres of ground, located in Toledo, Ohio. Brick iron roof building, erected in 1889, for the purpose of manufacturing wire nails, all complete and containing new 75-horse power engine and boilers, line shafting, etc., and side track connecting with twenty-two lines of railroad.
Address Jos. C. BONNER, Pres't
TOLEDO WIRE NAIL CO., TOLEDO, OHIO.

BRASS AND BRONZE CASTINGS
A SPECIALTY.
By a molder of 30 years experience. Castings guaranteed true to pattern. Get my prices.
GEORGE HIBSCH, 4 1-2 Plain St., Albany, N. Y.

BRASS-WORKING TOOLS.
SPECIAL MACHINERY.

BARDONS & OLIVER Cleveland, Ohio.
PRICES on APPLICATION
SCREW MACHINES.

FOOT and POWER LATHES
Drill Presses, Shapers, Band, Circular and Scroll Saws, Machinists' Tools and Supplies. Lathes on trial. Catalogues mailed on application.
SEBASTIAN LATHE CO. 43 & 45 Central Avenue, CINCINNATI, O.

Bridgeport Machine Tool Works
LATHES
E. P. BULLARD. PROPR. BRIDGEPORT, CONN.

NICHOLSON FILE COMPANY,
PROVIDENCE, R. I.

FILES AND RASPS
FOR EVERY VARIETY OF WORK.

THE BERLIN IRON BRIDGE CO.
Office and Works:
No. 8 Railroad Ave., East Berlin, Conn.
CHAS. M. JARVIS, Pres. and Chief Engineer. BURR K. FIELD, Vice-President.
FRANK L. WILCOX, Treasurer. GEO. H. SAGE, Secretary.

The above illustration is taken direct from a photograph, and shows the construction of an Iron Building, designed and built by us for The Newport News Ship Building & Dry Dock Co., at Newport News, Va., and used by them as a Machine Shop. The photograph was taken looking diagonally across the building to show the Traveling Crane and the Gallery. The building is 100 feet in width by 300 feet in length, the central portion being 50 feet and the wings each 25 feet in width. The wings are made two stories high. The central portion is controlled by a traveling crane, and the wings by jib cranes.

SEND FOR OUR ILLUSTRATED CATALOGUE.

5-TON TRAVELING HOIST.
Driven by 2 H. P. Electric Motor.
Other sizes furnished.
T. SHRIVER & CO., 333 East 56th St., N. Y.

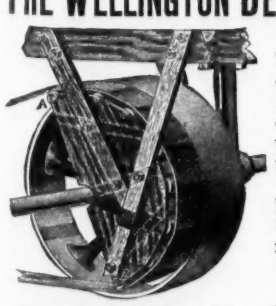
SOFT GRAY IRON CASTINGS.
From ⅛ oz. to 1000 lbs. Small Castings a Specialty. Light machinery wanted to build.
ONTARIO IRON WORKS
CANANDAIGUA, N. Y.

PATENTS
TRADE-MARKS, CAVEATS, COPYRIGHTS.
Send model or sketch for free advice as to patentability. Full information in my fifty page book, FREE.
Address
SAML. C. FITZGERALD, Atty.,
1003 F Street, - - WASHINGTON, D. C.

THE TOWNSEND FOUNDRY AND MACHINE SHOP
Machinery and Machinery Castings OF ALL KINDS.
PATTERN MAKING
And Job Work Desired.
RUFUS K. TOWNSEND, Prop.
ALBANY, N. Y.
Send for Gear Catalogue.
WE ARE FULLY EQUIPPED TO BUILD LIGHT AND HEAVY SPECIAL MACHINERY, AND WOULD BE PLEASED TO FURNISH ESTIMATES.

BUFFALO FORGES.
BUFFALO FORGE CO., BUFFALO, N. Y.

THE WELLINGTON BELT HOLDER.



Cut shows Holder in position beside driving pulley.

Large or small belts shifted from driving pulley and held at rest, and easily slipped back when machine is to be started.

It dispenses with loose pulleys, saves belts, and is perfectly safe.

It is *cheap*.

Write for descriptive circular and price list to

COOKE & CO.,
163 & 165 WASHINGTON STREET, NEW YORK,
And mention American Machinist.

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS AND IMPORTERS,
810 Walnut St., Philadelphia.
☞Our New and Revised Catalogue of Practical and Scientific Books, 87 pages, 8vo., and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

F. J. SCHMITT & CO.,
30 & 32 Franklin Street,
NEWARK, N. J.
SEND FOR CIRCULAR
VAUGHN'S PAT. POWER HAMMER
BUILT ON THOROUGHLY Mechanical Principles only.
Can be handled with ease.

GEARS AND RACKS
IN STOCK.
FULL LINE OF FILES, TOOLS, BELTING.

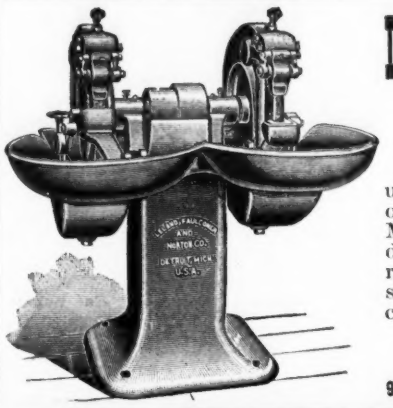
NEW AND SECOND-HAND LATHES.

FRASSE & CO.
90 TO 94 PARK ROW, NEW YORK.
(Near Brooklyn Bridge)
List "P" on application.

REDUCED PRICES OF LECOUNT'S LIGHT STEEL DOG.

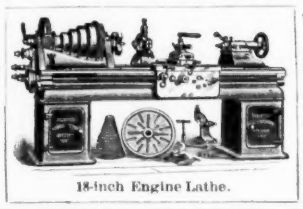
No.	INCH.	PRICE.	No.	INCH.	PRICE.
1	⅝	$ .35	8	2	$1.10
2	½	.35	Small Set of 8—5.50		
3	¾	.50	9	2½	1.40
4	1	.60	10	3	1.50
5	1¼	.75	11	3¼	1.70
6	1½	.85	12	4	1.90
7	1¾	1.00	Full Set of 12—12.00		

C. W. LeCOUNT, South Norwalk, Conn.
These goods are for sale by CHAS. CHURCHILL & CO., L'f'd, 21 Cross St., London, England.



LELAND, FAULCONER & NORTON CO.
WET EMERY GRINDER.
Any amount of water easily applied without the use of Pump, Hose, Treadles, Cocks, or any of the objectionable features common in this class of Machine. Truing Device, which is inexpensive, does the work perfectly and quickly. The whole rig practically as simple as the old-fashioned grindstone trough and much more effective. Send for circular.
LELAND, FAULCONER & NORTON CO.,
96 TO 106 BATES STREET, DETROIT, MICH.

FITCHBURG MACHINE WORKS,
MANUFACTURERS OF
FITCHBURG MODERN AND OTHER
SEND FOR CATALOGUE E.

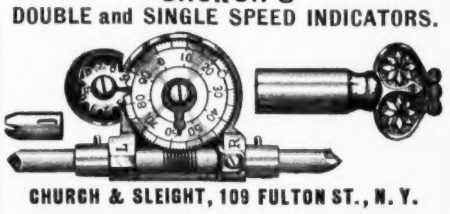


18-inch Engine Lathe.

THE CELEBRATED
ENGINE LATHE
METAL-WORKING MACHINES
FITCHBURG, MASS.

CATALOGUE of BOOKS
ON
STEAM, STEAM ENGINES, MACHINERY MECHANICS AND MECHANICAL ENGINEERING.
48 Pages, sent Gratis on application to
D. VAN NOSTRAND CO., Publishers,
23 Murray & 27 Warren Sts., New York.

CHURCH'S
DOUBLE and SINGLE SPEED INDICATORS.



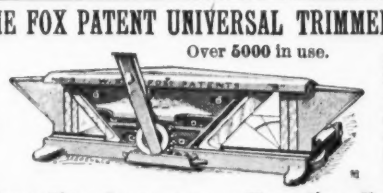
CHURCH & SLEIGHT, 109 FULTON ST., N. Y.

TO LET.
The Engine Works at Newburgh, N. Y., at present occupied by Wm. Wright, is offered to let from May 1st, 1892.
The Property consists of
MACHINE SHOP, FOUNDRY, BOILER, FORGE AND PATTERN SHOPS, with a full equipment of tools.
The works are located in the heart of the city, and convenient to railroad and river transportation.
For terms, apply to
HOMER RAMSDELL,
NEWBURGH, N. Y.

AMERICAN AND FOREIGN PATENTS.
We refer to well-known men and establishments in the machine trades for whom we have done business.
Epitome of the World's Patent Laws and Statistics Sent Free on Application.
(Registered English Patent Agent, according to Act of Parliament.)
F. W. BARKER'S PATENT AGENCY,
THE BENNETT BUILDING, 93-99 NASSAU ST., N. Y.
Monument Chambers, King William St., London, E. C., England.

OVER 20,000 COPIES SOLD.
Roper's Engineers' Handy-Book.
The most comprehensive and best illustrated book ever published in this country on the Steam-Engine, Stationary, Locomotive, and Marine, and the Steam-Engine Indicator. It contains nearly 300 Main Subjects, 1316 Paragraphs, 876 Questions and Answers, 52 Suggestions and Instructions, 105 Rules, Formulæ and Examples, 149 Tables, 195 Illustrations, 31 Indicator Diagrams, and 167 Technical Terms; over 3000 different subjects, with the questions most likely to be asked when under examination, before being commissioned as an engineer in the U. S. Navy or Revenue Service, or licensed as an engineer in the Mercantile Marine Service.
Price, postpaid, - $3.50.
FOR SALE BY ALL BOOKSELLERS.
☞*Descriptive Catalogues mailed free to any address.*
EDWARD MEEKS, Publisher,
No. 1012 WALNUT STREET, PHILADELPHIA, PA

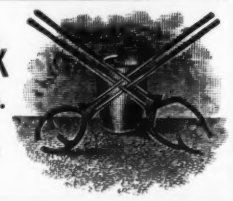
THE FOX PATENT UNIVERSAL TRIMMER.
Over 5000 in use.
ORIGINAL



IMPROVED
Saves Time, Saves money. Three Sizes, Four Styles, from New Patterns. *No Pattern Room Complete without Them.* Send for Catalogue.
Beware of Imitations. we will prosecute all Infringements.
THE FOX MACHINE CO.,
325 North Front Street, Grand Rapids, Mich.

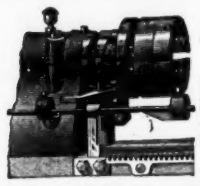
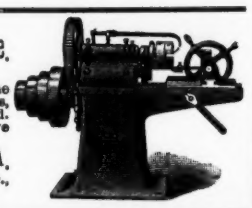
WORTHINGTON CONDENSER.
ONLY APPARATUS that can MAINTAIN a VACUUM on ENGINES and ELEVATE the discharge WATER to TANK at any height.
This feature is appreciated by PAPER MILLS, SUGAR REFINERIES, COTTON and WOOLEN MILLS.
HENRY R. WORTHINGTON,
NEW YORK,
BOSTON, PHILADELPHIA, CHICAGO, ST. LOUIS, ST. PAUL.

Established in 1874.
CLEVELAND TWIST DRILL CO.
Corner Lake & Kirtland Sts., Cleveland, O.
100 & 102 Reade Street, New York.
85 Queen Victoria St., London, Eng.

"HOWE'S SPECIAL" TOOL STEEL.
FOR THE Finest Work
ESTABLISHED 1859.

HOWE, BROWN & CO., L'T'D, PITTSBURGH, PA.
93 John St., New York. 127 Oliver St., Boston. 228 Lake St., Chicago.

GRAHAM TWIST DRILL AND CHUCK CO., DETROIT, MICH., U. S. A.
SOLE MANUFACTURERS OF
GRAHAM'S GROOVED SHANK TWIST DRILLS AND CHUCKS.

Endorsed by Practical Mechanics Everywhere. Send for Catalogue.

ADAMS

Automatic Bolt-Threading & Nut Tapping Machine.
Made in all Sizes to Cut from 1-4" to 6".
The simplest and most durable machine in existence. The threading head is made entirely of steel. No links, levers, springs, caps, cases, blocks or die rings in or about the head. Separate Heads and Dies Furnished. Write for descriptive circular and price list to
Capitol Mfg. Co., 125 to 137 Rees St., Chicago, Ill., U. S. A.
Agents for Great Britain, CHARLES CHURCHILL & CO., Ltd., 21 Cross Street, Finsbury, London, E. C., England.


SEND FOR CATALOGUE.
WORCESTER MACHINE SCREW CO.

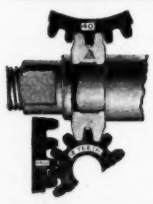
Manufacturers of Set, Cap & Machine Screws, Studs, etc.

MACHINERY For Reducing and Pointing Wire.
ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING.
For Machines or Information, address the Manufacturer,
S. W. GOODYEAR, Waterbury, Ct.

MACHINISTS' SCALES,
PATENT END GRADUATION.
We Invite Comparison for Accuracy with all others.
EVERY SCALE GUARANTEED. SEND FOR LIST.
COFFIN & LEIGHTON, SYRACUSE, N. Y.

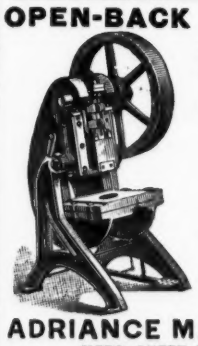
MARK YOUR TOOLS WITH A STEEL STAMP.

SEND FOR PRICE LIST NO. 4.

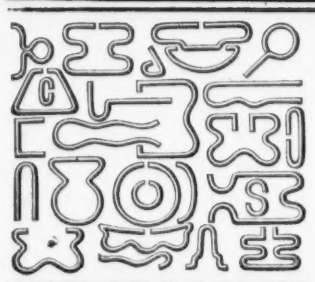

CLOUGH'S IMPROVED DUPLEX GEAR CUTTER.
One Cutter cuts a Pitch from 12 teeth to a Rack inclusive, of variable shape, made for either Involute or Epicycloidal form of tooth. Information and Circulars of **R. M. CLOUGH,** Tolland, Conn.

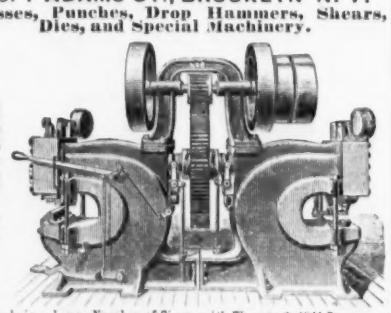
BEVEL GEARS,
Cut Theoretically Correct.
For particulars and estimates apply to
HUGO BILGRAM,
MACHINIST,
Successor to
BREHMER BROS.,
440 N. 12th St., Philadelphia, Pa.

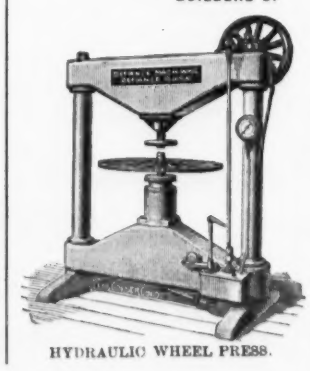
LIVE DRAFTSMEN
Send stamp for Catalogue of best time and labor-saving specialties. B. E. SAWYER, Athol, Mass.

OPEN-BACK ADJUSTABLE

Power Press
Vertical
—OR—
Inclined.
For Cutting and Forming
SMALL ARTICLES OF
Sheet Metal, Leather, Paper, Etc.
ADRIANCE MACHINE WORKS,
MFRS. SHEET METAL MACHINERY.
Plymouth & Jay Sts., - BROOKLYN, N. Y.

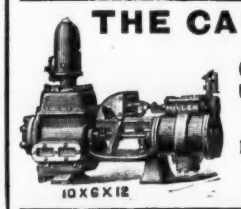
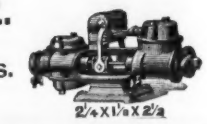
THE PECK PATENT DROP PRESS
MINER & PECK MF'G CO.
SUCCESSORS TO BEECHER & PECK
NEW HAVEN, CONN.
DROP FORGINGS


BLAKE & JOHNSON,
WATERBURY, CONN.
BUILDERS OF
WIRE FORMING MACHINES
WITH F. B. MANVILLE'S PATENT SLIDING FORMER.
For making articles from the coil, of either round, half round, flat, or square wire, similar in shape to those shown in the cut herewith. Also similar articles made to order.
Send samples of articles required, and mention quantity wanted, that we may quote prices for either machine or the goods, whichever may be desired.

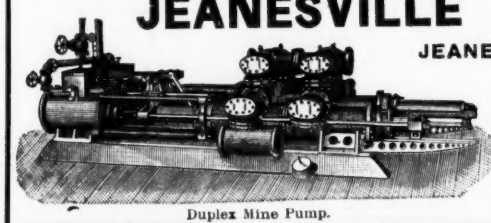
E. W. BLISS CO., Ltd.
NO. 1 ADAMS ST., BROOKLYN N. Y.
Presses, Punches, Drop Hammers, Shears, Dies, and Special Machinery.
SEND FOR SECTIONAL CATALOGUE.

Made in a Large Number of Sizes, with Throats 6-48" Deep.
OWNERS ALSO OF
THE STILES & PARKER PRESS CO.

Defiance Machine Works,
DEFIANCE, OHIO, U. S. A.
BUILDERS OF

HYDRAULIC WHEEL PRESS.
HUB, SPOKE, WHEEL, BENDING, WAGON, CARRIAGE, HANDLE AND HOOP MACHINERY.
Send for Catalogue.

THE BUFFALO STEAM PUMP CO.,
MANUFACTURERS OF BUFFALO, N. Y.
STEAM PUMPS
FOR ALL SERVICES.
NEW YORK OFFICE, 76 JOHN STREET.

THE CANTON STEAM PUMP CO., CANTON, OHIO.
MANUFACTURERS OF

10X6X12
STEAM PUMPS for EVERY PURPOSE.
BOILER FEEDERS A SPECIALTY.
NEW DESIGNS AND IMPROVEMENTS.
ABSOLUTELY FIRST CLASS.
Discounts and Terms on Application.

2¼X1⅞X2½

SNOW STEAM PUMP WORKS,
BUFFALO, N. Y.
STEAM PUMPS, POWER PUMPS, &c., FOR ALL SERVICES.

JEANESVILLE IRON WORKS,
JEANESVILLE, LUZERNE CO., PA.
BUILDERS OF

Duplex Mine Pump.
SPECIAL PUMPS OF ALL KINDS.
DUPLEX OR SINGLE, SIMPLE OR COMPOUND.
MINE PUMPS, SINKING PUMPS, PRESSURE PUMPS, VACUUM PUMPS, ARTESIAN WELL PUMPS, POWER PUMPS, ETC., ETC.

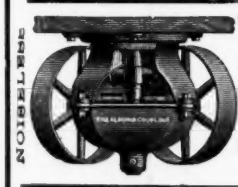
"PRACTICAL DRAWING."
By J. G. A. MEYER.
This valuable series of 93 articles having been concluded, copies of the **American Machinist** containing them will be sent by mail to any address in the U. S., Canada or Mexico, for $4 65, or single copies, 5 cts. each, postpaid.

Order now before our stock of papers is exhausted.
ADDRESS:
American Machinist,
203 BROADWAY,
NEW YORK.

"MODERN LOCOMOTIVE CONSTRUCTION."
By J. G. A. MEYER.
This valuable series of 106 articles having been concluded, copies of the **American Machinist** containing them will be sent by mail to any address in the U. S., Canada or Mexico for $5.30, or single copies, 5 cts. each, postpaid.

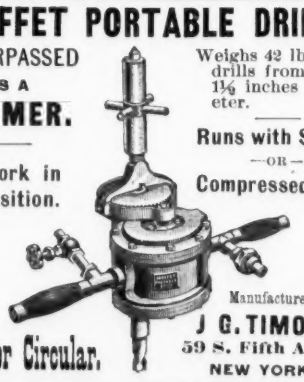
WM. BERKEFELD'S FOSSIL MEAL COMPOSITION.
The Only Genuine Fossil Meal.

The best non-conducting material known for Steam Pipes and Boilers. Can be easily removed and repeatedly reapplied.
ITS PLASTIC NATURE INSURES AN ABSOLUTELY TIGHT JOINT.
Requires less thickness than any other covering, and is therefore the CHEAPEST.
FOSSIL MEAL CO., 2 Cedar Street, N. Y.
A. GIESE, Proprietor.
Trade-mark. W. B. C.


The Almond Coupling
A NEW quarter turn motion to replace quarter turn belts and bevel gears.
T. R. ALMOND, MFR.,
83 and 85 Washington Street
BROOKLYN, N. Y.

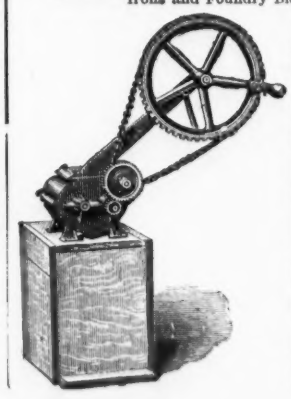
VOLNEY W. MASON & CO.,
Friction Pulleys, Clutches and Elevators,
PROVIDENCE, R. I.

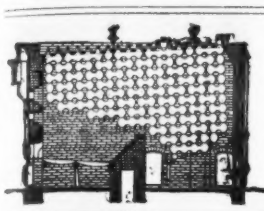
BOSTON GEAR WORKS,
35 Hartford St., Boston, Mass.
HEADQUARTERS for GEARS.
Book on Gears, 170 Illustrations, $1.50.
635 SIZES OF BRASS GEARS.
JOB GEAR CUTTING OF ALL KINDS.
Spur, Bevel, Spiral, Ratchet, Worm, Rack, Elliptic Index Plates, etc. Very small or large. SEND FOR 1892 CATALOGUE, 80 Illustrations, FREE to any business firm.

MOFFET PORTABLE DRILL.
UNSURPASSED AS A **REAMER.**
Will work in any position.

Weighs 42 lbs. and drills from ⅜ to 1¼ inches diameter.
Runs with Steam
—OR—
Compressed Air.
Manufactured by
J. G. TIMOLAT,
59 S. Fifth Ave.,
NEW YORK.
Send for Circular.

COMBINATION CENTER DRILLS cheaper and better than anything else for the purpose. Size of shank 3-16 in. Size of drills 1-8 in. and 3-32 in., or both ends alike, either 1-8 in. or 3-32 in. Sent postpaid to any address in U. S. or Canada on receipt of price. $1.50 per Doz. JOHN T. SLOCOMB & CO., P. O. Box 1339, Providence, R. I.

Deposited in the U. S. $845,000.00.
Policies issued giving full protection to Employers against loss by Claims from Employes on account of Accident. Rates Proportioned to Risks of Occupation. One Premium the only Payment during year. No Contingent or other Liability on part of Employer.
CHIEF OFFICE IN THE UNITED STATES:
71 KILBY ST., BOSTON, MASS.
ENDICOTT & MACOMBER,
Managers and Attorneys.
BOSTON: Samuel Appleton, 28 Central Street.
NEW YORK: Edmund Dwight, Jr., General Agent, 51 Cedar Street.
MIDDLE DEPARTMENT: Tattnall Paulding, Resident Adviser, John G. Hooven, Manager; John M. Ash, Jr., General Agent 416 to 420 Walnut Street, Philadelphia.
CHICAGO: Geo. A. Gilbert, 226 and 228 La Salle Street.
ST. LOUIS: F. D. Hirschberg Bro., 130 N. Third Street.
AGENTS IN ALL THE PRINCIPAL CITIES.

ROOTS' NEW ACME HAND BLOWER.
For Blacksmiths, etc. Slow Speed, Positive Blast Is Durable, Compact and Cheap; also Portable Forges, Tuyere Irons and Foundry Blowers.

P. H. & F. M. ROOTS, Mfrs.
CONNERSVILLE, IND.
E. S. TOWNSEND, Gen. Agt., 163 & 165 Washington St. NEW YORK.
COOKE & CO., Selling Agts.,
Please Mention This Paper.



Absolute Safety from Destructive Explosion—Highest Attainable Economy of Fuel—Rapid Generation of Dry or Superheated Steam—Durability—Low Cost of Maintenance—Ease of Transportation and General Efficiency are among the advantages possessed by the "Wharton-Harrison" form of boiler.

Send for Descriptive Pamphlet—Drawings, Specifications, and Estimates promptly furnished for any amount of power from 4 H.P up.

State requirements and consider our proposition.

HARRISON SAFETY BOILER WORKS,
PHILADELPHIA, PENNA.

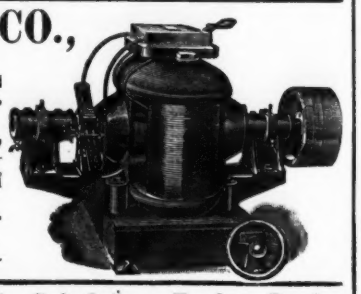
NEW YORK, N. Y. 41 Dey Street. | CHICAGO, ILL. 137 La Salle Street. | ATLANTA, GA. 9 No. Pryor Street.

THOS. H. DALLETT & CO.,
York Street & Sedgley Ave., Philadelphia.

Manufacturers of
Portable Drills, Hand Drills, Boiler Shell Drills, Light Drill Presses.

ELECTRIC MOTORS,
Specially adapted for driving Machine Tools, Cranes, Elevators, Pumps, Presses and other Machinery.

ELECTRIC GENERATORS,
For installation of Complete Power Plants.

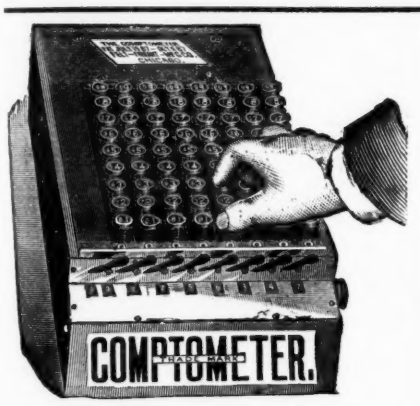


PORTABLE DRILLING MACHINES,
MANUFACTURED BY
Albert L. Colburn,
No. 4 Wall Street,
NEW HAVEN, CONN.
Send for Catalogue.

Walker's Grindstone Truing Device
Will give face of Stone any desired shape, and Truing Tool is easily and cheaply renewable.
Send for Price-list of Truing Device and also of
ENTIRE GRINDSTONE OUTFITS.

D. F. WALKER,
20 E. Canal St.
PHILA., PA.

NORTON EMERY WHEEL CO.,
WORCESTER, MASS.
Send for Illustrated Catalogue.



Performs Addition, Subtraction, Multiplication, Division, Interest, Percentage, Discounts, Etc., Etc.

It is now in use in hundreds of banks and counting-rooms and in the offices of five governments.

It insures accuracy, saves 60 per cent. of time, and affords entire relief from mental strain. Why don't you get one?

The Albert Dickinson Co., Seed Merchants, city, write: "We have now purchased the third Comptometer, which fact speaks for itself."

Messrs. Martin D. Stevers & Co., Commission Merchants, Chicago, write: "The greatest assistance ever invented for the bookkeeper."

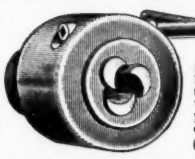
Potsdam Red Sandstone Co., Potsdam, N. Y., write: "It is no exaggeration to say that the Comptometer enables one man to do the work of two. A Comptometer used daily several hours continually for nearly two years shows absolutely no wear."

Mr. C. I. Wade, Cashier Pittsburg National Bank of Commerce, writes: It does about two men's work around here.

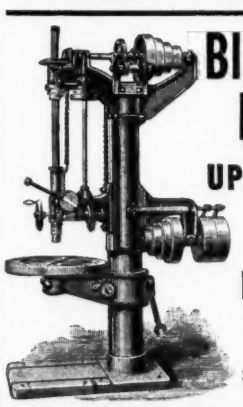
FELT & TARRANT MFG. CO.,
Gen'l Office & Factory, 52 to 56 Illinois St., Chicago.
Call or send for pamphlet.

American Standard Gauge & Tool Works,
WILMINGTON, DEL.

Makers of Implements for Standard Measurements.
Over 48,000 in Use.
Crescent Gauge. Flat Bar Gauge.
JAS. A. TAYLOR & CO.



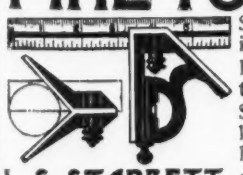
WANTED
—To sell the patent or to get the FRANCIS DRILL CHUCK manufactured *on royalty*. It is self-gripping, simple in construction, and has great gripping power. A ⅜ in. chuck will twist off a 15-32 in. drill.
G. W. FRANCIS, 318 N. 4th St., Reading, Pa.



BICKFORD DRILL CO.,
BUILDERS OF
UPRIGHT RADIAL AND UNIVERSAL RADIAL DRILLS.
Boring & Turning Mills.
3 PIKE STREET, CINCINNATI, O.

CUT
WITH OUR
NO. 3 FLEETWOOD SAW
Fitted for FOOT or STEAM Power.
A HANDY TOOL TO HAVE IN YOUR SHOP.
Write for description and price to
TRUMP BROS. MACHINE CO.
MANUFACTURERS,
WILMINGTON, DELAWARE.
FOR SALE BY
CHAS. CHURCHILL & CO., Limited,
No. 21 Cross Street, Finsbury, London, England.

STARRETT'S
FINE TOOLS



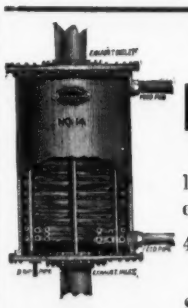
Skilled mechanics prefer them. Live dealers sell them. Send for free illustrated Catalogue.

L. S. STARRETT, Athol, Mass., U.S.A.
LONDON AGENTS: Chas. Churchill & Co., Limited, 21 Cross St., Finsbury, E. C.

GRAPHITE
Plumbago
BLACK LEAD

Ground and prepared in quantities from ¼ lb. to a shipload. Lubricating Graphite a specialty. If you are at all interested in Graphite it will pay you to correspond with us, as different kinds are required for different purposes. All letters promptly answered.

Jos. Dixon Crucible Co.,
JERSEY CITY, N. J.



THE NATIONAL Feed-Water HEATER.

A brass coil Heater delivering water to the boiler at 210° Fahrenheit.

400,000 Horse power sold. Prices Low. Satisfaction universal.

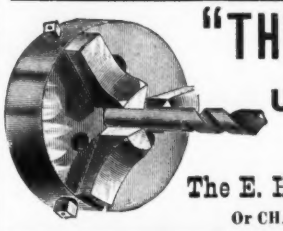
THE NATIONAL PIPE BENDING CO.,
32 River Street, NEW HAVEN, CONN.

Westcott Chuck Co., Formerly **Oneida Steam Engine & Foundry Co., Oneida, N.Y., U.S.A.**
Manufacturers of all kinds of
LATHE AND DRILL

CHUCKS.
Send for Illustrated Catalogue.

Under Westcott's Patent.
Capacity Little Giant Improved.

No.	Diameter.	Holding Drills.
00	1¼ inch.	0 to ¼ inch,
0	2¼ "	0 to ½ "
1	2¾ "	0 to ⅝ "
2	3½ "	0 to 1 "
2½	4 "	0 to 1 in., ex. strong.
3	6 "	0 to 1½ inch.
4	6½ "	0 to 2 "



"THE HORTON LATHE CHUCK."
MORE THAN 300 SIZES AND STYLES. COMPRISING
Universal Chucks, Independent Chucks, Combination Chucks,
Of Every Description. Send for 52 page Illustrated Catalogue.
The E. HORTON & SON CO., Windsor Locks, Conn., U. S. A.
Or CHAS. CHURCHILL & CO., Ltd., 21 Cross St., Finsbury, London, Eng.

NOTICE

We have just added to our line of patent Face-Plate Jaws an 8 inch. We now carry in stock three sizes—8 inch, 10 inch and 12 inch.

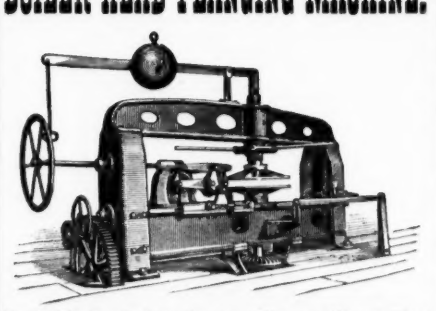
Send for new Catalogue of Chucks to
THE CUSHMAN CHUCK CO.,
HARTFORD, CONN.

CHUCKS
ALL STYLES.
NEW REVERSIBLE JAWS
(DOVETAILED.)
MANUFACTURED BY
THE HOGGSON & PETTIS MFG. CO.,
Est. 1849. NEW HAVEN, CONN.

POSITIVE DRIVING DRILL CHUCK.
For either straight or taper Shank Drills.

Has the Holding Power of Taper Socket, together with all the advantages of the common Friction Chuck. Write for Illustrated Price List and Discounts to
THE PRATT CHUCK CO.,
Clayville, N. Y., U. S. A.

BOILER HEAD FLANGING MACHINE.



Rapid Work. Perfect Heads, with or without Dies. No Hole in Plate. Construction Simple. Price Reasonable.

JACOB CLARK, Mfr., Germantown, Philadelphia, Pa.

GRINDING MACHINERY

Water Tool Grinder.

PRICES ON APPLICATION.

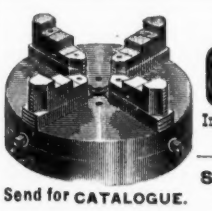
THE HORNER MACHINE CO.,
HOLYOKE, MASS.

CHARLES MURRAY
ENGRAVER ON WOOD
58 ANN ST. NEW YORK.

PINION KEY CHUCKS.

A geared scroll chuck with the pinion on the key shaft. It has been used for years by the largest electrical and instrument factories in the U. S. It is warranted durable and true. Ask for it at your dealer's.

THE D. E. WHITON MACHINE CO.
No. 5 Oak St., New London, Conn.
S. A. SMITH, 23 S. Canal St., Chicago, Western Agt.



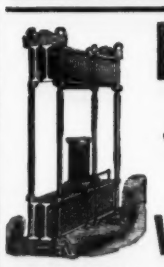
SKINNER CHUCKS
Independent, Universal and Combination LATHE CHUCKS.
—Also, DRILL CHUCKS.—
Send for CATALOGUE.
SKINNER CHUCK CO.
NEW BRITAIN, CONN.

Chucks The **NATIONAL.**
INDEPENDENT, UNIVERSAL, COMBINATION.
Strongest. Easiest to change. Best Finish. Reversible Jaws (patented) giving 5 changes including every possible desired position.
NEW CATALOGUE, illustrated, sent free. Liberal discounts. Prompt shipment. Address
THE NAT'L CHUCK MAN'F'G CO., Mt. Vernon, N. Y.

McGRATH'S PATENT
Emery Grinding, Polishing and Buffing Machines.
Bearings yielding or rigid at will
Wheels *always true and in balance*, dispensing with use of diamond tool and chilled burr, and saving the time, labor, and cutting away of wheels, *otherwise wasted in truing*. Send for Catalogue.

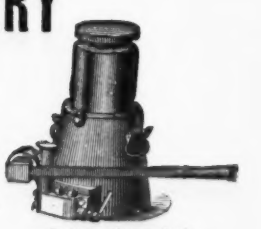
McGRATH & COLLINS,
COHOES, N. Y.

PURE
ALUMINUM.
The Pittsburgh Reduction Co.
116 WATER ST.,
PITTSBURGH, PA.,
Offer Aluminum, guaranteed to be equal in purity to the best in the market, at the lowest rates obtainable. Prices given on application. Aluminum sheet, wire and castings at best rates.
ALUMINUM POLISH, very efficacious and non-poisonous, suitable for household use as well as for manufacturing purposes.
ALUMINUM SOLDER.
Correspondence solicited.



WAGON WHEEL HUB PRESS.

HYDRAULIC MACHINERY
PRESSES, PUMPS, PUNCHES,
JACKS, VALVES, FITTINGS,
PACKINGS,
ACCUMULATORS.
Watson & Stillman, Mfrs.
204, 206, 208 & 210 E 43d St., New York.

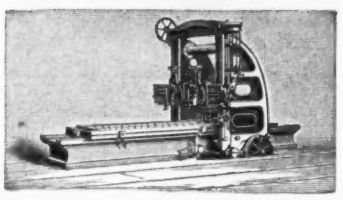


Outside Pump Jack.

PUTNAM MACHINE COMPANY,

BUILDERS OF
METAL PLANERS
MANUFACTURED

From New and Original Designs, Embodying Advanced and Patent Improvements.



Fitchburg, MASS., U.S.A.
ESTABLISHED 1836.

Represented in Great Britain by CHAS. CHURCHILL & CO., Ltd., 21 Cross St., Finsbury, London, England.

In Sizes from 18 inch to 100 inch Square.

THE STANDARD TOOL CO., Cleveland, Ohio.

Manufacturers of STRAIGHT-LIP INCREASE

TWIST DRILLS

SOLID AND SHELL REAMERS, MILLING CUTTERS, TAPS, SOCKETS.
"STANDARD" TWIST DRILL GRINDING MACHINE CHUCKS AND SPECIAL TOOLS.

SUSPENSION AND POST DRILLS.

FOR BOILER MAKERS.

UNIVERSAL RADIAL DRILL CO. CINCINNATI, O. U.S.A.

MILLIKEN & D'AMOUR'S
IMPROVED BENCH DRILL PRESSES
ARE OUTSELLING ALL OTHERS.

SEND FOR NEW DRILL PRESS PAMPHLET.

MILLIKEN & D'AMOUR,
51 JOHN & 2 DUTCH STREETS, NEW YORK.

Turret Drill Press.

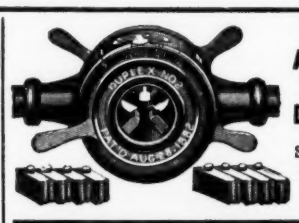
SIX SPINDLE.

Drills from 1/16 to 1/4 hole, speed from 250 to 2000 Rev.

Suitable for a large variety of work and is operated with ease and rapidity.

SEND FOR CIRCULAR.

A. D. QUINT, Hartford, Ct.



HART'S ADJUSTABLE "DUPLEX" DIE STOCKS FOR PIPE.

Send for Illus. Circular.

HART MFG. CO., 16 Wood Street, Cleveland, Ohio.

Pat. KEY-SEAT SETTING GAUGE
PATENT UNIVERSAL DEPTH ANGLE AND SCREW-CUTTING CENTER
J. WYKE & CO TWIST DRILL GAUGE
Fine Machinists Tools E. BOSTON, MASS. Send for LISTS

FOOT LATHE
SCREW CUTTING
ADDRESS FOR $40 CIRCULAR.
NARRAGANSETT MAC. CO.
BOX 1008 PROVIDENCE, R.I.

ANNOUNCEMENT.

Milwaukee, Wis., April 26, 1892.

We beg to inform the public in general, and Machine Tool users in particular, that all contracts existing between the Lodge & Davis Machine Tool Co., of Cincinnati, O., and ourselves, by which they controlled our output of Milling Machines, have this day been canceled by mutual consent.

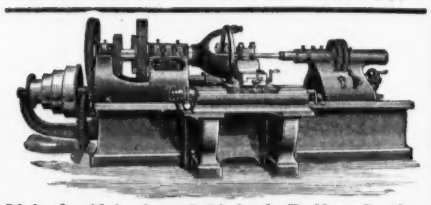
In the future the genuine Improved Kempsmith Milling Machines can be purchased directly from us or our regularly accredited agents.

We are now in much better shape to make prompt shipments.

With some new sizes of Millers, and other sizes in progress, we will soon have a full line.

We trust that a desire to furnish nothing but a strictly high grade tool, at a moderate price, coupled with fair business methods, will enable us to satisfy our customers in the future as we have endeavored to do in the past.

KEMPSMITH MACHINE TOOL CO.

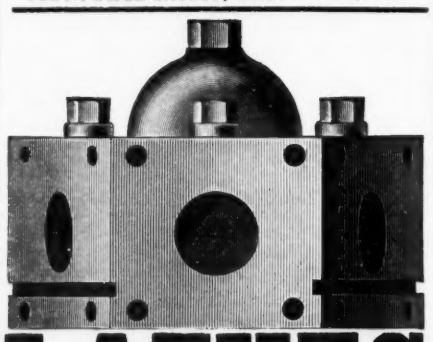


30 inch, 42 inch and 60 inch Pulley Lathes

For Simultaneously Boring and Turning Pulleys, both straight and crowning face, Cone Pulleys, Gear Blanks, and a variety of other work.

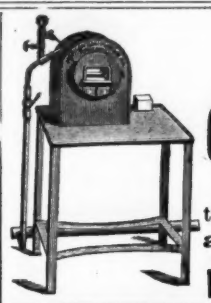
Manufactured by
The Henley Machine Tool Works,
RICHMOND, IND.
Duplicate Circular mailed on application.

W. C. YOUNG M'F'G CO., Worcester, Mass. Manufacturers of
Engine Lathes, Hand Lathes,
FOOT POWER LATHES, SLIDE RESTS, ETC.



LATHES

NOVEL DESIGN,
GISHOLT MACHINE CO.
Madison, Wis., U. S. A.



AMERICAN GAS FURNACE CO.,

DESIGNERS AND MANUFACTURERS

GAS BLAST FURNACES.

Send for Catalogue. Estimates made for any mechanical operation requiring **high, even** and **controllable temperature.**

No. 80 NASSAU STREET, NEW YORK.

A. R. KING M'F'G COMPANY,

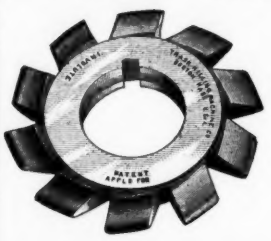
ERIE, 11th and 12th Streets, JERSEY CITY, N. J.

HEAVY AND LIGHT **CASTINGS** IRON OR BRASS.

MFRS. OF BOILER MAKERS' TOOLS, SCREW PUNCHES, TUBE EXPANDERS, PACKER RATCHETS, TUBE CUTTERS, ETC.

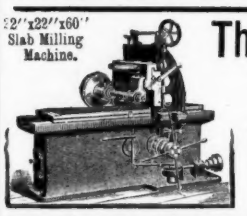
GENERAL MACHINE WORK. Write for CATALOGUE. CORRESPONDENCE INVITED.

TRASK MILLING MACHINE CO.,



MANUFACTURERS OF
GEAR CUTTERS,
Bevel, Mitre, Straight-Face, and Irregular Cutters
OF ALL DESCRIPTIONS
FOR
MILLING METALS.

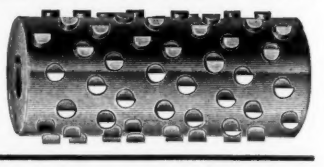
118 SOUTH STREET, BOSTON, MASS.



22" x 22" x 60" Slab Milling Machine.

The INGERSOLL MILLING MACHINE CO.,

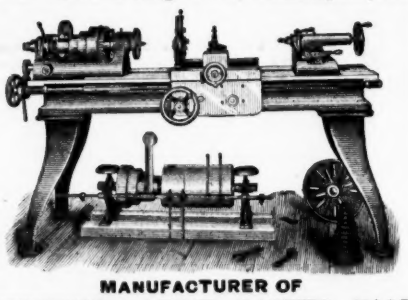
ROCKFORD, ILLS.
Manufacturers
Ingersoll Patent Cutter, Ingersoll Slab Milling Machines.



Pat. Dec. 24, 1889.

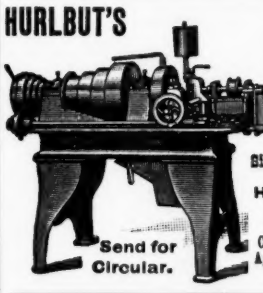
A. FALKENAU,

11th Street & Ridge Ave., Philadelphia, Pa.



MANUFACTURER OF
SUPERIOR 14-INCH LATHES, TOOL GRINDING MACHINERY, TRAVELING CRANES, ETC.
Special Machinery designed and constructed.

HURLBUT'S



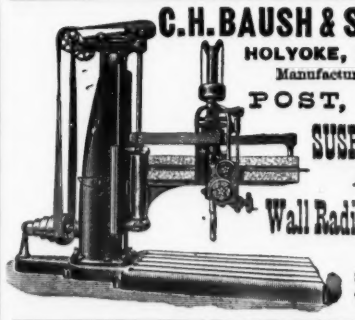
Send for Circular.

Patent Cutting-off and Centering Machine.

Sizes, 2", 3", 4", 5", 6".
MADE BY
HURLBUT, ROGERS MACHINE CO.
South Sudbury, Mass.
Chas. Churchill & Co., Ltd. Agents, 21 Cross St., London, England.

C. H. BAUSH & SONS,

HOLYOKE, MASS.
Manufacturers of
POST, SUSPENDED AND Wall Radial Drills
From the smallest to the largest.



THE McNAULL UNIVERSAL RADIAL DRILLS.

Newest and best in the market. Furnished in five sizes, from a wall to a 10-ft. swing. Send for circulars.

McNaull Mach. & Fdy. Co.
RONCEVERTE, W. VA.

Pawling & Harnischfeger
Milwaukee, Wis.

Horizontal Drill and Boring Tools.
Column Facing Lathes.
Pit Lathes.
Truck Wheel Grinders.
Boring Bars, &c.
Electric, Steam and Hand Cranes.

RADIAL DRILLS

We will sell a 52" Radial Drill with arm to move up and down the Column for less money than you can buy a 40" Upright Drill for. Has table arm that moves around column, and table revolves in arm. The Radial Arm is balanced, has Power Feed to Spindle, and is powerfully driven, has great stiffness; no spring to Radial Arm under heavy pressure. Has heavy base plate. Truth, accuracy and workmanship of the best. Note following testimonial.

DIETZ, GANG & CO.,
Manufacturers of MACHINISTS' TOOLS,
CINCINNATI, OHIO.

DIETZ, GANG & Co., City.

Gentlemen:—I am pleased to say that your Radial Drill is all you claim for it. Respectfully,

OHIO MACHINE TOOL CO.
PER WM. LODGE.

IN ENGLAND.

Americans or others desirous of having high class machinery or tools manufactured in England are invited to communicate with

GRENFELL & ACCLES, L'T'D.
HOLFORD ENGINEERING WORKS.
Perry Barr, Birmingham, England.

G. & A.'s extensive works are fitted throughout with the latest and best types of American machines and tools, and are conducted upon the American system, under the superintendence of American Engineers (formerly of Hartford, Conn.)

THE TOOL CATALOGUE OF 1892

EVERY reader of the American Machinist should have a copy of our new TOOL Catalogue. A most complete book of 704 pages, bound handsomely in cloth and printed on good paper. Book will be sent express paid on receipt of $1.00 to any part of the world. Money paid for book will be refunded with the first order amounting to $10.00 or over. As a book of reference, information, etc., every person having occasion to use Tools should own a copy, even if they do not purchase their supplies from us.

MONTGOMERY & CO.

Mechanics' Tools and Supplies,

Register Letters containing Money and Stamps.

105 FULTON STREET, NEW YORK CITY.

MORSE TWIST DRILL AND MACHINE COMPANY,

Manufacturers of **Morse Patent Straight-Lip Increase Twist Drills.** New Bedford, MASS.

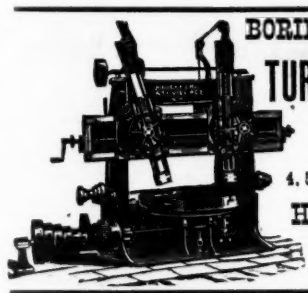
Solid and Shell Reamers, Beach's Patent Self-Centering Chuck, Bit Stock Drills.
DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.

F. E. REED & CO.,
Worcester, Mass.
MANUFACTURE
ENGINE LATHES
HAND LATHES, FOOT LATHES AND MILLING MACHINES.
Manning, Maxwell & Moore,
Selling Agents, 111 Liberty St., New York.
515 Phenix Building, Chicago.

PLAIN MILLING MACHINES

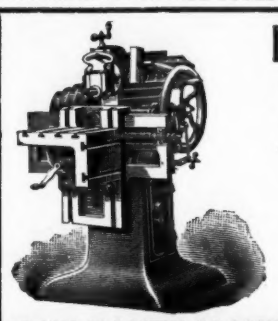
SOMETHING NEW.

The Cincinnati Milling Machine Co.,
CINCINNATI, OHIO.



BORING AND TURNING MILLS,
4, 5 & 6 Ft. Swing.
H. Bickford,
Lake Village, N. H.

CHAS. A. STRELINGER & CO.,
Tools, Supplies and Machinery,
DETROIT, MICH.



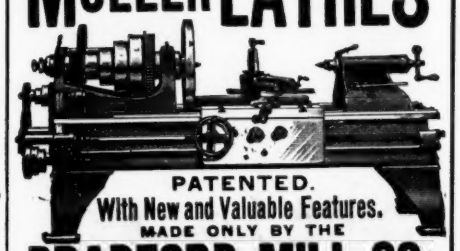
Lathes, Planers, Drills, Slotters, Etc.
NEW HAVEN MANUFAC'G CO.,
New Haven, Conn.

FOR SALE CHEAP.

One No. 11x Screw Machine with Clutch back gears and power feed to turret; spindle hole 2¼ inches; length of bed 6 feet 6 inches; swing 20 inches; weight 3,500 pounds; width of driving pulley 4 inches; six holes in turret 2¾ inches in diameter; working length 12 inches. Above machine has never been used except as show machine in Philadelphia store. Write for discount and prices. Will sell cheap for cash, as we want the room.

JONES & LAMSON MACHINE CO.,
SPRINGFIELD, VT., U. S. A.

MULLER LATHES



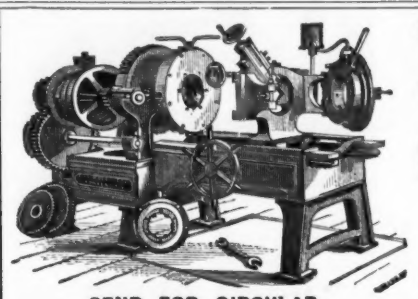
PATENTED.
With New and Valuable Features.
MADE ONLY BY THE
BRADFORD MILL CO.
8th & Evans, CINCINNATI, OHIO.
Photographs and Prices on application.

FOR
Substantial, Well Made, Low Price, Patented,
20 Inch Drills,
With latest improvements. Lever, Combination or Wheel Feed, address
Sibley & Ware,
SOUTH BEND - INDIANA.

IRON PLANERS.

Extra Heavy. Latest Design. All Modern Improvements.

L. W. POND MACHINE CO., WORCESTER, MASS.



SEND FOR CIRCULAR.

D. SAUNDERS' SONS,

Manufacturers of
Pipe Cutting & Threading Machines
For Pipe, Mill and Steam Fitters' Use.
TAPPING MACHINES,
For Steam Fitting, also
Steam and Gas Fitters' Hand Tools.
21 Atherton St., Yonkers, N. Y.

GAGE MACHINE WORKS,

MANUFACTURERS OF
MACHINE TOOLS,
WATERFORD, N. Y.

FOOT POWER LATHES

For Electrical and Experimental work. For Gunsmiths and Tool Makers. For General Machine Shop Work.

High grade tools; elegant in design, superior in construction. The best foot power lathes made, and quality considered the cheapest. Send for catalogue and prices.

W. F. & JNO. BARNES CO.,
1995 Ruby St., ROCKFORD, ILL.

OUR NEW
25-Inch CRANK SHAPER
IS NOW READY.
JNO. STEPTOE & CO., Cincinnati, O.

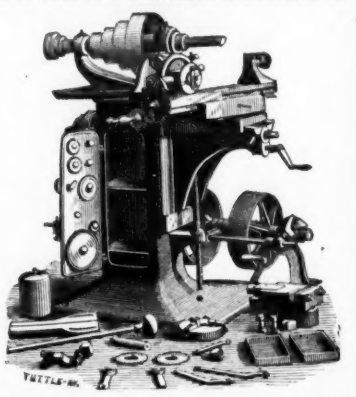
BOYNTON & PLUMMER,
WORCESTER, MASS.
Manufacturers of
Shaping Machines, Drilling Machines, Bolt Cutting Machines.
CHAS. CHURCHILL & CO., Lt'd, Agents.
21 Cross St., Finsbury, London, England.

PRENTICE BROS.
Manufacturers of
Lathes & Upright Drills.
Lathes from 10 in. to 20 in. swing. Largest Variety of Drills manufactured in the world
Worcester, Mass.

For Sale by CHAS. CHURCHILL & CO., Ltd. 21 Cross Street, Finsbury, London, England.

THE GARVIN MACHINE CO.,

Manufacturers of Machinists' and Iron Workers' Tools, Lathes, Planers, Milling Machines and Drills. Special Tools for all kinds of manufacturing to order.



Gear and Rack Cutting, Milling and Index Drilling to Order.

LAIGHT & CANAL STS., NEW YORK.

Price $10
NO GAUGES.
NO BELT.
Every Machine Guaranteed.

BARKER'S IMPROVED CENTER GRINDING MACHINE.
Manufactured by
WM. BARKER & CO.
CINCINNATI, O.
SEND FOR CIRCULAR.

THE HENDEY MACHINE COMPANY,
TORRINGTON, CONN.,
Jan. 16, 1891.

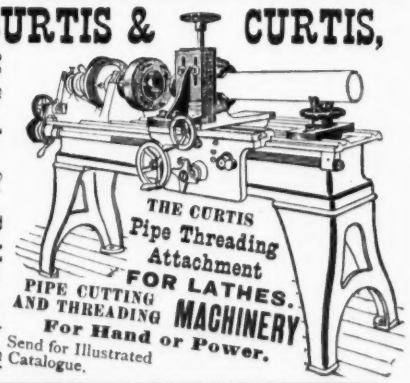
J. E. SNYDER,
Worcester, Mass.

Dear Sir:—In answer to yours of 14th, we would say, we have two of your 32-inch drills in our works which have been in use for over a year. We find them a very convenient drill to use, and they have given us satisfaction in every way.

Yours truly,
H. J. HENDEY,
Prest.

CURTIS & CURTIS,

66 Garden St., Bridgeport, Ct.



Send for Illustrated Catalogue.

NEW SHOP. PERFECT EQUIPMENT. NO MAKESHIFTS.

AMPLE ROOM. PERFECT LIGHT. EASILY REACHED.

Having added a Blacksmith Shop containing a 350 lb. Steam Hammer to our already extensive plant, we are now prepared to estimate on forgings of all kinds. We carry a full line of milling cutters in stock.

W. D. FORBES & CO.,
HOBOKEN, N. J.

FINE TOOL AND MACHINE WORK.

CONTRACT, JOB, OR DAYS' WORK.

SEND FOR OUR NEW CATALOGUE.

13th STREET, AND HUDSON, HOBOKEN.

The "Simplex" Glass-Tube Cutter.

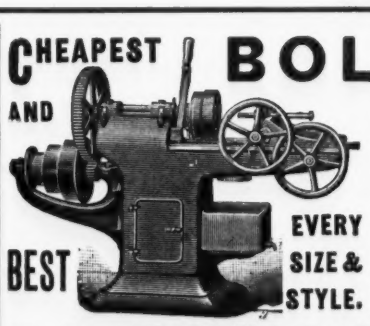
This simple little instrument will be found quite as effective in its operation as any one of the numerous Glass-Tube Cutters costing five times its price. Its trifling price places it within the reach of every one who has use for such a tool.

It Sells at Sight.

DO NOT SEND US ANY POSTAGE STAMPS.

MANUFACTURED BY
PANCOAST & MAULE, Philada., U. S. A.

CHEAPEST AND BEST BOLT CUTTERS.



EVERY SIZE & STYLE.

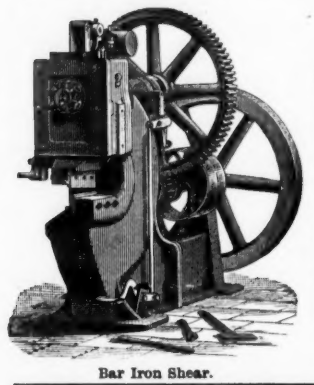
H. B. BROWN & CO.,
EAST HAMPTON, CT.

Here is a Letter

which Captain A. B. Reck, formerly of the Royal Danish Engineers, gave to us unsolicited: "I am glad to state that the regulators of the **Mason Regulator Co.**, of **Boston,** are preferred for others in the **Danish Navy,** by the shipbuilding firms here and by brewers, sugar manufacturers and for heating apparatus where steam from high-pressure boilers is used for heating. I have sold many of these regulators during the last five years, and I have not had a single case where I have had trouble of them."

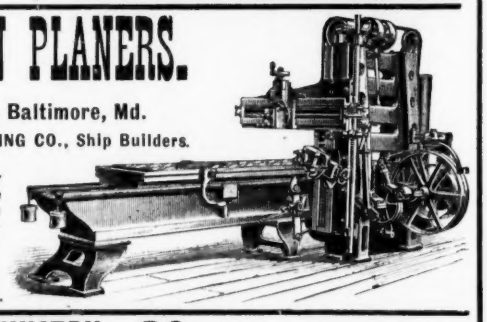
[Signed] A. B. RECK,
Kjobenhavn, Denmark.

WILLIAM SELLERS & CO., Incorporated.
PHILADELPHIA, PA.
BUILDERS OF
MACHINE TOOLS FOR WORKING IRON AND STEEL.
Improved TURNTABLES for LOCOMOTIVES, CARS and PIVOT BRIDGES.
High Speed Power Traveling Cranes and Hand or Power Swing Cranes, Shafting, Pulleys, Hangers, &c., for transmission of power. Improved Self-Adjusting Injector of 1876. Self-Acting Injector of 1887. Fixed-Nozzle Automatic Injector of 1885.
INJECTORS for ALL CONDITIONS of LOCOMOTIVE and STATIONARY SERVICE.

THE LONG & ALLSTATTER CO.,
HAMILTON, OHIO.
Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple Belt and Steam-Driven
PUNCHES & SHEARS,

Bar Iron Shear.
POWER CUSHIONED HAMMER. ALSO OVER 300 SIZES.
Send for New Catalogue.

ESTABLISHED 1842
ROBERT POOLE & SON CO.
ENGINEERS AND MACHINISTS.
MACHINE MOULDED GEARING.
ALL KINDS OF TRANSMISSION MACHINERY
OF THE HEAVIEST CLASS.
BALTIMORE, MD.

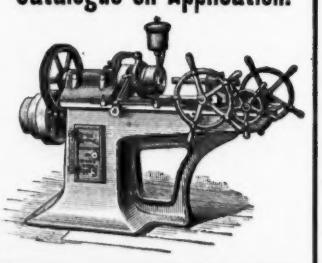
CUTS FASTER THAN ANY OTHER TOOL ON EARTH
WRIGLEY'S EMERY WHEEL DRESSER
T. WRIGLEY PAT. JUNE 17, 1890. No. 1
NEVER GETS DULL.
SEND FOR CIRCULAR. T. WRIGLEY 85 FIFTH AVE. CHICAGO. U.S.A.

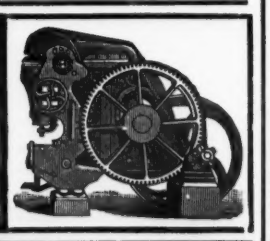
THE OPEN SIDE IRON PLANERS.
THE DETRICK & HARVEY MACHINE CO., Baltimore, Md.
CHARLES HILLMAN SHIP & ENGINE BUILDING CO., Ship Builders.
PHILADELPHIA, Nov. 3, 1891.
GENTLEMEN: The Open Side Planer, built by you, has given us entire satisfaction. The workmanship is of first quality, and we have found that the capacity of the machine is increased very much by the Open Side. We are,
Yours truly,
THE CHARLES HILLMAN SHIP & ENGINE BUILDING CO.,
JOSIAH HILLMAN, Secretary.


ACME MACHINERY CO.
CLEVELAND, OHIO.
Manufacturers of
ACME BOLT & RIVET HEADERS,
Acme Single & Double Automatic BOLT CUTTERS.
Cutting from 1-8 in. to 6 in. diameter.
Also SEPARATE HEADS and DIES.
FIRST PREMIUM, CINCINNATI CENTENNIAL.

PAT. DEC. 5, 1882.
PAT. DEC. 4, 1883.
PAT. AUG. 28, 1885.

Bolt and Nut Machinery.
Catalogue on Application.

Complete Outfits for Bolt and Car Shops.
Bolt Cutters, Bolt Pointers,
Upsetters and Benders,
Bolt Headers, Nut Tappers,
Nut Machines,
Washer Machines, Car Link and Pin Machinery.
The National Machinery Co., Tiffin, O.


PUNCHING & SHEARING MACHINERY
BOILER MAKERS' ROLLS.
NEW DOTY MANUFACTURING CO.
JANESVILLE, WISCONSIN.


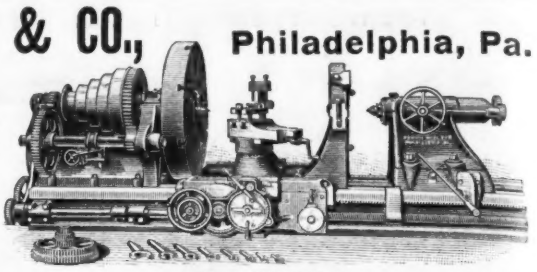
ENERGY MFG. CO., 1115 S. 15th St., PHILADELPHIA.
MANUFACTURERS OF
QUICK LIFTING AND LOWERING ROPE HOISTING MACHINES.
Adjustable Clamping Blocks, Drill Guides, Elevators, Etc.
PATENT CENTER GRINDERS Guaranteed to do accurate work.
Will grind Lathe Centers true if sprung or broken, quicker than they can be turned and filed. SEND FOR CATALOGUE.

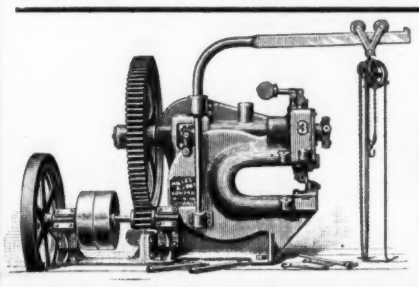
Largest Line in the U. S.
Complete Outfits or Single Machines Furnished for any Purpose.
THE EGAN CO.,
239 to 259 W. FRONT ST.,
CINCINNATI, OHIO, U. S. A.
Originators and Builders of
WOOD-WORKING MACHINERY
OF THE MOST ADVANCED TYPE FOR THE SAVING OF TIME AND LABOR.
Pattern Machinery a Specialty.

Send for Catalogue.

COMPRESSION SHAFT COUPLINGS.
W. H. NICHOLSON & CO., Wilkes-Barre, Pa.

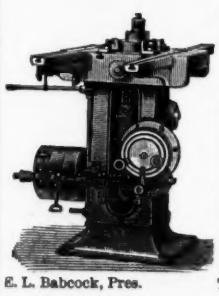
SAW TABLES FOR PATTERN MAKERS.
ROYLE MACHINE WORKS,
PATERSON, N. J.

BEMENT, MILES & CO., Philadelphia, Pa.
BUILDERS OF
METAL-WORKING
MACHINE TOOLS
FOR RAILROAD SHOPS, LOCOMOTIVE AND CAR BUILDERS, MACHINE SHOPS, ROLLING MILLS, STEAM FORGES, SHIP YARDS, BOILER SHOPS, BRIDGE WORKS, ETC.
New York Office, Equitable Building.
GEORGE PLACE, Agent.

NEW 63-INCH LATHE.

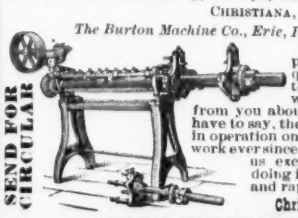

THE HILLES & JONES CO.,
WILMINGTON, DEL.
—MANUFACTURERS OF—
MACHINE TOOLS
—FOR—
Boiler Makers, Bridge Builders, Ship Builders, Railroad Shops, Locomotive and Car Builders, etc.
CUT SHOWS OUR SINGLE SHEAR WITH CRANE.

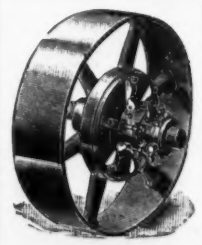
WYMAN & GORDON,
WORCESTER, MASS.
DROP FORGINGS.

PATENT OILERS, CYLINDER SIGHT FEED CUPS.
Government Regulation
POP SAFETY VALVES,
For Stationary, Marine and Locomotive Boilers.
J. E. LONERGAN & CO., BRASS FOUNDERS AND FINISHERS,
211 Race Street, Philadelphia, Pa.
CATALOGUE FREE ON APPLICATION.


E. L. Babcock, Pres.
GIANT KEY SEATER.
Rack-Cutting Attachment Key-Making Machines.
VALLEY MACHINE CO.,
SAGINAW, MICH.
Cuyahoga Falls, O., Nov. 25, '91.
Gentlemen: The large KEY SEATER which we bought of you has now been in operation for a number of months, and we have been using it almost constantly since it was purchased, and we are very much pleased with it indeed. We also have a machine made by another firm, which we thought was a good machine, but now that we have both in our factory, and use them both, we like yours very much the best.
The Falls Rivet & Machine Co.

KEUFFEL & ESSER CO.
NEW YORK AND CHICAGO.
Manufacturers of
Drawing Materials, Surveying Instruments, &c.
Paragon Drawing Instruments, Extra and Best Quality, German Drawing Instruments, Paragon, Duplex, Universal, Anvil Drawing, Helios, Blue Process Papers, Scales, Triangles, T-Squares, Drawing Boards, Standard Profile and Cross-section Papers. Catalogue to professional people on application.

THE ERIE KEY-SEATING MACHINE.
MANUFACTURED BY
THE BURTON MACHINE CO.,
302 Peach St., Erie, Pa., U. S. A.
CHRISTIANA MACHINE CO.,
Manufacturers of Shafting, Pulleys, Gearings, &c.
CHRISTIANA, PA., Jan. 23, 1891.
The Burton Machine Co., Erie, Pa.
GENTLEMEN: – Replying to your inquiry concerning the Erie Key Seater which we purchased from you about a year since, we have to say, the machine has been in operation on our general line of work ever since we got it, and gives us excellent satisfaction, doing its work accurately and rapidly. Very truly,
Christiana Machine Co.
SEND FOR CIRCULAR

SPECIAL MACHINERY BUILT TO ORDER.

The Moore & White Co.,
15th St. & Lehigh Ave.,
PHILADELPHIA, PA.
MFRS. OF
The "Moore & White" Friction Clutches AND Cut-off Couplings.
Send for Circulars.


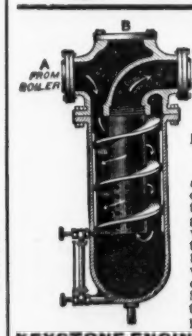
THE PERKINS DRAW STROKE TRIMMER,

An Indispensable Tool for all Bench Woodworkers. Latest and Best Design. Infringers Prosecuted. Trial, not orders, solicited.
PERKINS & CO.,
Grand Rapids, Mich.
STOCKS, NEAVE & CO.
Manchester, England.

The Morton Key-Seating Machine
THE LEADER.
With recent patented improvements, we guarantee to do the following class of work.
To cut key-ways through 1¼-inch hole in hubs or sleeves 23 inches long, in iron, brass or steel, also make it dovetail to insert feather key.
Will cut through 4-foot hub, through 5-inch hole. Our new centering chuck and setting attachment the work can be set exactly, without the use of a scale or rule. Our new binding attachment takes the place of bolts, with a key-way and key to fit it.
For particulars address THE MORTON M'F'G CO., MUSKEGON HEIGHTS, MICH.

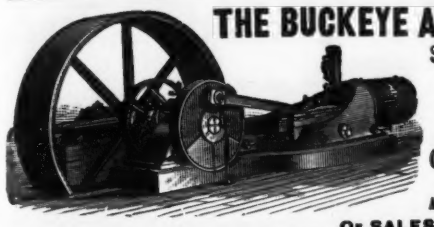
WINTERTON METAL POLISH.

Best polish and quickest cleaner known for HOT or COLD Brass, Copper, Nickel, &c., or finished Iron and Steel. *Samples free.* Try it.
W. W. CALLERY & CO.,
36th & BUTLER STREET,
PITTSBURGH, PA.

DRY STEAM.


Simpson's Centrifugal Steam Separator.
For Supplying Clean and Dry Steam to Engines, Dry Houses, etc.
Place Separator as close to engine as possible, the steam taking a spiral course between the threads causes the water to be thrown by centrifugal force against the outer walls, while the dry steam goes through the small holes to center of pipe. Steam can enter at A or B, as convenience may require; also used in conveying steam long distances, for Steam Hammers, Dry Houses, Water Gas Generators, and for all purposes where Dry Steam is necessary.
KEYSTONE ENGINE AND MACHINE WORKS,
Fifth and Butlewood Streets, Philadelphia,
Or, A. T. ARTHUR, Selling Agent, 13 Cortlandt St., N. Y.

THE BUCKEYE AUTOMATIC CUT-OFF ENGINES.



SLOW SPEED, MEDIUM SPEED AND HIGH SPEED ENGINES,

Simple, Compound and Triple-Expansion Engines.

HIGH-PRESSURE BOILERS.

Complete Steam Power Plants of Highest Attainable Efficiency.

Address BUCKEYE ENGINE CO., Salem, O.

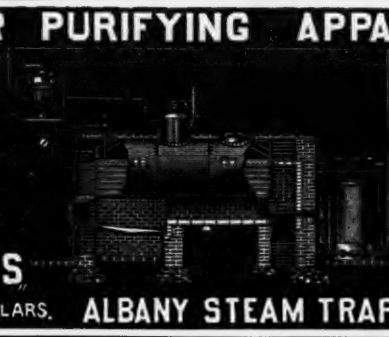
OR SALES AGENTS:

BUCKEYE ENGINE COMPANY SALES AGENCY, No. 10 Telephone Building, New York City.
A. A. HUNTING, John Hancock Bld'g, Boston, Mass. N. W. ROBINSON, 97 Washington St., Chicago, Ill.
ROBINSON & CARY COMPANY, St. Paul, Minn. A. L. FISH, No. 61 First St., San Francisco, Cal.
A. H. MORSE, 511 Commercial Building, St. Louis, Mo. J. M. ARTHUR & CO., Portland, Oregon.

KENSINGTON ENGINE WORKS, LIMITED, PHILADELPHIA.

Sole Licensees and Manufacturers for New Jersey (South of Trenton), Eastern Pennsylvania, Delaware, Maryland, and Virginia.

BOILER PURIFYING APPARATUS.



ALSO MANUFACTURERS OF

RENEWABLE SEAT VALVES

RETURN STEAM TRAPS

DUPLEX WATER FILTERS

PUMP GOVERNORS AND STEAM PUMPS

SEND FOR CIRCULARS.

ALBANY STEAM TRAP CO. ALBANY, N.Y.

"OTTO" GAS ENGINE WORKS.

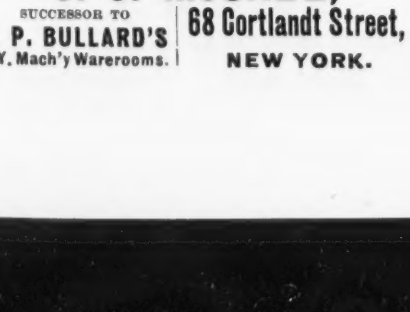
SCHLEICHER, SCHUMM & CO.,

33d and Walnut Sts., PHILADELPHIA.

Branch Office, 151 Monroe St., CHICAGO.

New York Agency, 18 Vesey St., N. Y.

Over 36,000 Engines in Use



Guaranteed to consume 25 to 75 per cent. less Gas than any other Gas Engine doing the same work.

THE TWISS IMPROVED AUTOMATIC ENGINE

With LIBERATING Valve Gear.

Manufactured by NELSON W. TWISS, 25 Whitney Ave., NEW HAVEN, CONN

Send for price before purchasing elsewhere.

STRONG, WELL BUILT SERVICEABLE STEAM ENGINES

12 to 100 Horse Power. Every Engine tested under full load.

Adapted to Heavy, Continuous Work.

SUITABLE Tubular & Firebox BOILERS on hand for immediate delivery.

CHANDLER & TAYLOR CO. INDIANAPOLIS, IND.

FRICTION CLUTCH PULLEYS and CUT-OFF COUPLINGS.

THE WOODCOCK CLUTCH

Simplest and best in the world. Address

ALLENTOWN FOUNDRY & MACHINE CO., ALLENTOWN, PA.

LINK-BELT

ENGINEERING CO.
NICETOWN.
PHILA.
49 DEY ST.
NEW YORK.

Elevators, Conveyors, Manila Rope Power Transmission Machinery, Ewart Detachable Link Belting, Dodge Chain, Howe Chain, etc. Western Connection, Link-Belt Machinery Co., Chicago, Ill.

SPECIAL LIST.
SECOND-HAND MACHINERY.
Will be Sold Low.

ENGINE LATHES.

36 in. Swing, 18 ft. bed, Heavy Pattern, Triple Geared, Compound Rest, Power Cross Feed and extra Rest, complete. Spindle, 11 in. diam. First-class order.
60 in. x20 ft. Heavy Pattern.
34 in. x11 ft. " " Screw Feed.
24 in. x12 ft. Putnam C'p'd Rest and Cross Feed. A1 order.
20 in. x10 ft. Ames, C'p'd Rest and Cross Feed. " "
18 in. x8 ft. New Haven. Screw Feed. Fair order.
16 in. x6 ft. Pond Rod and Screw Feeds. Good order.
14 in. x6 ft. Ashton Hand, complete. " "

PLANER.

48 in. wide, 10 ft. long, Heavy Standard Pattern, with auto. feeds. A1 order.

SHAPERS.

9 in. Stroke, Gould, Crank Motion. Good order.
9 in. " Hewes & Phillips, Crank Motion. Good order.
15 in. " Extra Heavy, " " " "

SCREW MACHINES.

Brown & Sharpe, No. 5, with Chasing Bar and Spring Chuck.
Garvin No. 1, Wire Feed and Chuck, complete.
" No. 3, 1 7-16 in. hole, with Clutch Gears and Tools.
Jones & Lamson, No. 3, 15-16 in. hole, with Back Gears, Auto. Feed and Tools, complete. A1 order.
Jones & Lamson, No. 11, 2 1-8 in. hole, Clutch Gears, Auto. Turret Feed, Chasing Bar, Chuck, and Tools.

RADIAL AND UPRIGHT DRILLS.

Radial, Extra Heavy. Arm 3 ft. Good order.
Upright, 24 in. Back Gears, Auto. Feed (Ames). " "
" 20 in. Pratt & Whitney. " "

HORIZONTAL AND UPRIGHT BORING MILLS.

Horizontal, 66 in. x24 ft., for Large Cylinder Boring and Facing. Heavy Pattern.
Horizontal, 40 in. x10 ft., Nicholson's latest pattern.
Upright, 37 in., Boring and Turning Mill, Bridgeport. A1 order.

MISCELLANEOUS.

Slotter, 8 in., Standard Pattern, Auto. Feeds. Good order.
Pipe Machine, 3-4 in. to 4 in., with Dies, complete.
Boiler Rolls, 6 ft. 6 in., Standard Pattern.
Profiling Machine, 2 Spindle, Pratt & Whitney. A1 order.

Large stock Latest Improved New Tools, best standard makes.

J. J. McCABE,

SUCCESSOR TO E. P. BULLARD'S N.Y. Mach'y Warerooms.

68 Cortlandt Street, NEW YORK.

THE LACKAWANNA GREASE CUP

Has a wide reputation as the CLEANEST, MOST EFFECTIVE, and MOST ECONOMICAL device on the market for the lubrication of machinery bearings.

Liberal Discount to the Trade.

—MANUFACTURED BY—

Lackawanna Lubricating Co.,

SCRANTON, PA.

GENERAL AND EXPERIMENTAL MACHINE WORK. BEST FACILITIES IN CHICAGO
NATIONAL MACHINE WORKS 35 S° CANAL S^T CHICAGO ILL

SWIVEL BASE.

4" OFFSET JAW VISE.

Specially adapted for drill press work where chucks cannot be used, and equally good for special or regular bench work.

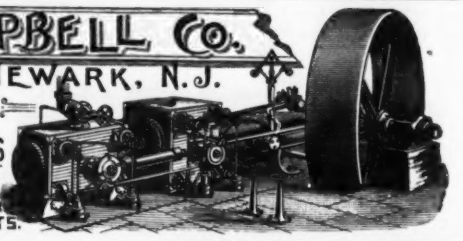
Send for catalogue of full line of the most improved designed, and best finished machinists', plumbers', coach makers' and pattern makers' vises and small tools.

HOLLANDS MFG. CO., ERIE, PA.

THE WATTS, CAMPBELL CO.

MANUFACTURERS OF IMPROVED CORLISS STEAM ENGINES IN FULL VARIETY.

NEWARK, N.J.



CONTRACTS TAKEN FOR COMPLETE POWER PLANTS.

Eclipse Corliss Engine.

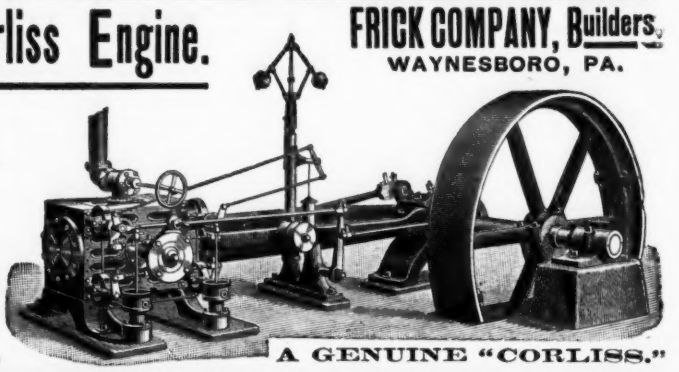
FRICK COMPANY, Builders.
WAYNESBORO, PA.

NON-CONDENSING, CONDENSING COMPOUND. 40 TO 1,000 H.P.

Send for Circulars.

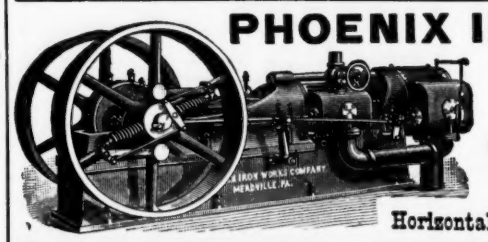
ICE-MAKING AND REFRIGERATING MACHINERY.

Send for Special Circular.



A GENUINE "CORLISS."

PHOENIX IRON WORKS CO.



MEADVILLE, PA.
New York, 15 CORTLANDT ST.
Chicago, 418 CHAMBER OF COMMERCE.

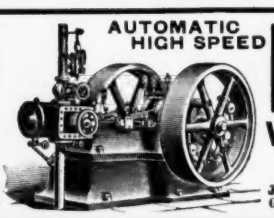
Sole Manufacturers of the "Dick & Church" Automatic Cut-off Engine,

Single, Tandem Compound, and Triple Expansion.

Horizontal Tubular and Manning Vertical Boilers.

WESTON ENGINES

AUTOMATIC HIGH SPEED



HIGH PRESSURE BOILERS AND COMPLETE POWER PLANTS

WESTON ENGINE CO., PAINTED POST, N.Y.

REPRESENTATIVES.
JULIAN SCHOLL & CO., 126 Liberty St., N.Y.
GEO. D. HOFFMAN, 82 Lake St., Chicago.

HIGH GRADE AUTOMATIC CUT-OFF ENGINES.

SIMPLE, TANDEM AND CROSS COMPOUNDS

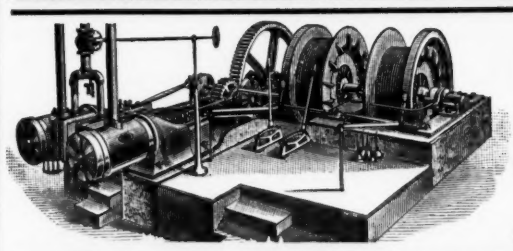
No other engine has a perfectly balanced valve.

OUR GUARANTEE. WHO DARE MEET IT?

The engine shall not run one revolution slower when fully loaded than when running empty, and a reduction of boiler pressure from the greatest to that necessary to do the work, will not reduce the speed of engine one revolution. Any engine failing to meet this guarantee becomes the property of the purchaser upon payment of one dollar. Send for Catalogue.

Branch Offices, 141 Liberty St. New York, N.Y. 412 Washington Ave. St. Louis, Mo.

J. H. McEWEN MFG. CO. RIDGWAY, PA.



WIRE ROPE

HOISTING AND HAULAGE PLANTS

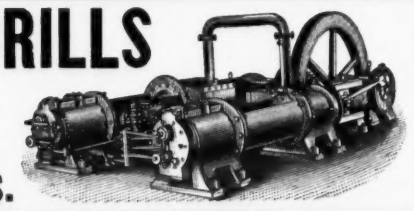
For Coal Mines, &c., a Specialty.

OVER 100 NOW RUNNING SUCCESSFULLY.

Gum-lined Sheaves, Coal Crushers, Narrow Gauge Locomotives.

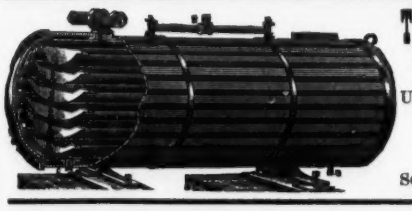
J. & J. B. MILHOLLAND, 240 Fifth Avenue, PITTSBURGH, PA.

ROCK DRILLS AND AIR COMPRESSORS.



AIR COMPRESSORS WITH COMPOUND AIR CYLINDERS, AND COMPOUND STEAM CYLINDERS WITH MEYER OR CORLISS VALVES.

Rand Drill Co.,
23 Park Place,
NEW YORK, U. S. A.



The HOPPES Live-Steam Feed-Water Purifier,

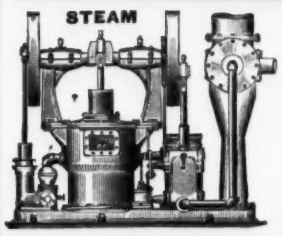
Guaranteed to Prevent Scale in Boilers.

Using any kind of water. Hard Sheet Steel Troughs.

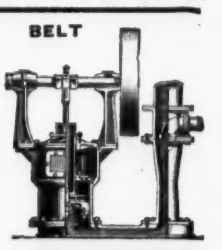
Easily Cleaned.

HOPPES MANUFACTURING CO., Send for Catalogue D. SPRINGFIELD, OHIO.

STEAM



BELT



CONOVER CONDENSERS.

BELT AND STEAM DRIVEN.

Compound Condensing Corliss Engine on Independent Condenser.

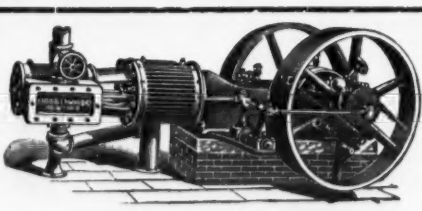
HANDSOME CATALOGUE FREE.

THE CONOVER MFG. CO., 95 Liberty St., N.Y.

THE IMPROVED BALL ENGINE.

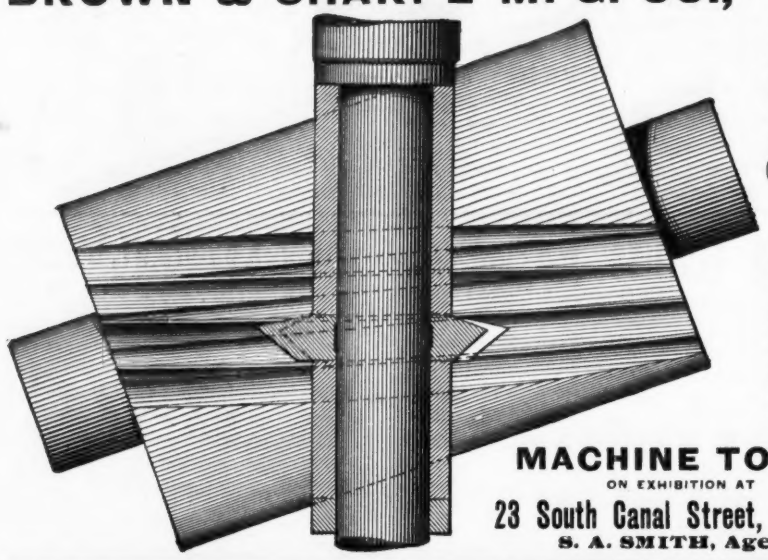
AS BUILT BY The Ball & Wood Co.

OFFICE, 15 Cortlandt Street, NEW YORK.



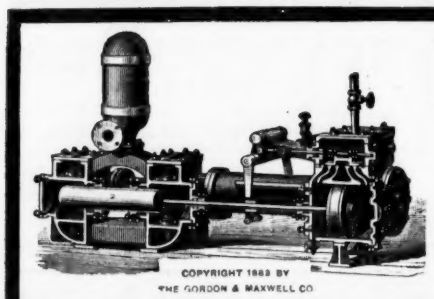
Is superior in DESIGN, FINISH and WORKMANSHIP. In REGULATION and ECONOMY it has no equal. Built with new tools from new patterns and after long experience, it marks the latest step in steam engineering.

BROWN & SHARPE MFG. CO., PROVIDENCE, R. I.



CUTTERS FOR USE ON Milling Machines.

MACHINE TOOLS
ON EXHIBITION AT
23 South Canal Street, Chicago.
S. A. SMITH, Agent.



Duplex Steam Pumps
AND
Water Works Machinery.

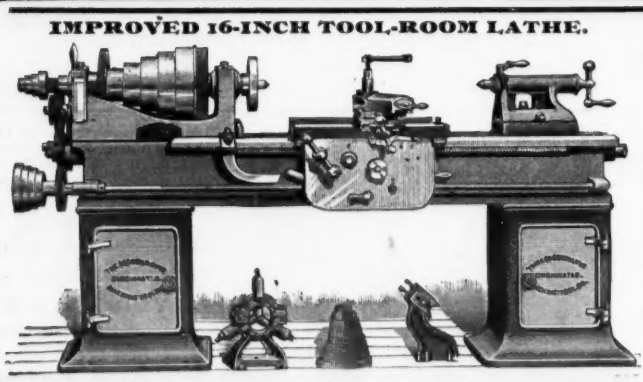
THE GORDON STEAM PUMP CO.
HAMILTON, OHIO.

BRANCH HOUSES:
NEW YORK, 98 Liberty Street.
PITTSBURGH, Lewis Block.
CHICAGO, Phenix Building.

INCREASED SALES
Show that our customers appreciate the value of improvements made in
JENKINS PACKING.
It can be used again and again. Does not **ROT** or **BURN** out. Have you tried it recently? If not, DO SO! Look for "Trade Mark." *JENKINS BROS., New York Philadelphia, Boston and Chicago.*

GRANES THE YALE & TOWNE MFG CO.
STAMFORD CONN
NEW YORK CHICAGO PHILA. BOSTON

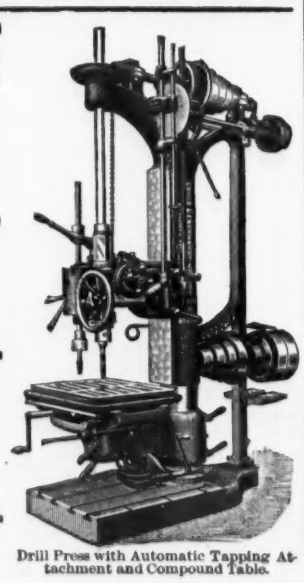
IMPROVED 16-INCH TOOL-ROOM LATHE.



Graduated Taper Attachment.
Graduated Compound Rest.
Graduated Power Cross-Feed.
Graduated Tail Stock Spindle.
Lead Screw Inside.
Reverse in Apron.
Cabinet Legs.
Capable of doing the most accurate work.

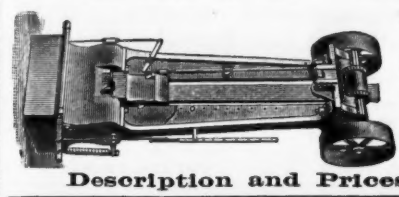
THE LODGE & DAVIS MACHINE TOOL CO., Works, CINCINNATI, O.
NEW YORK STORE, 64 Cortlandt St. CHICAGO STORE, 68 and 70 So. Canal St. CLEVELAND STORE, 32 So. Water St. PITTSBURGH STORE, Mkt. and Water Sts.

GOULD & EBERHARDT
NEWARK, N. J., U. S. A.
BUILDERS OF
HIGH-CLASS MACHINE TOOLS.
INCLUDING
EBERHARDT'S PATENT
DRILL PRESS AND TAPPING ATTACHMENT.
STANDARD DRILL PRESS.
Double Triple Quick "Stroke" Shapers.
ENTIRELY AUTOMATIC GEAR CUTTERS.
Write for Circulars.



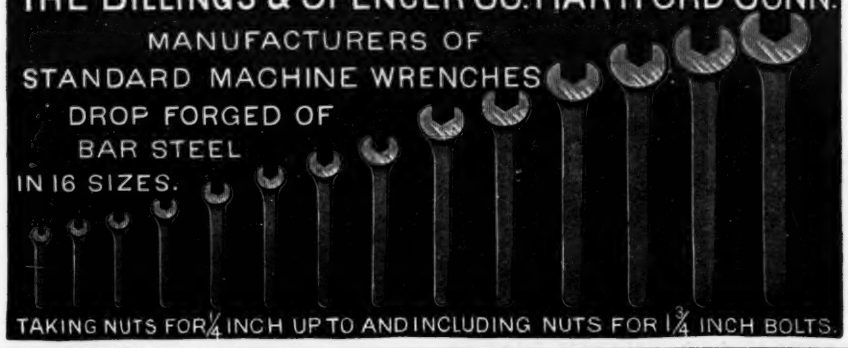
Drill Press with Automatic Tapping Attachment and Compound Table.

The PRATT & WHITNEY CO., Hartford, Conn.
—MANUFACTURE—
DROP HAMMERS,



Punching and Trimming Presses, Forging and Trimming Dies.
Die-Sinking Machines, Hand Bolt Heading Machines.
ROLL GROOVING MACHINES FOR FLOUR MILL USE.
Spiral Shear Punches, Solid Adjustable and Opening Die Bolt Cutters.
Description and Prices Furnished on Application.

THE BILLINGS & SPENCER CO. HARTFORD CONN.
MANUFACTURERS OF
STANDARD MACHINE WRENCHES
DROP FORGED OF
BAR STEEL
IN 16 SIZES.



TAKING NUTS FOR ¼ INCH UP TO AND INCLUDING NUTS FOR 1¾ INCH BOLTS.

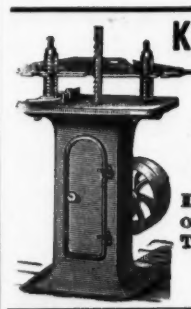
WARNER & SWASEY,
MACHINE TOOLS CLEVELAND, OHIO.

For IRON and BRASS WORK.
Illustrated Catalogue on application.

THE METROPOLITAN AUTOMATIC INJECTOR
OPERATED Entirely by One Handle.

The Most Successful Injector Made.
ANYONE CAN OPERATE THEM.
Every engineer can repair the injector without sending it to the manufacturers. Carried in stock by the Largest Supply Houses in the U. S.
Western Agent, CRANE CO., CHICAGO.
JENKINS BROS., New York, Southern Agents.
The Hayden & Derby Mfg. Co.,
SOLE MANUFACTURERS,
NO. 111 LIBERTY STREET, NEW YORK.

GEO. W. FIFIELD,
MANUFACTURER OF
ENGINE LATHES
FROM 17 TO 50 IN. SWING.
Cuts, Photographs and Prices furnished on application.
Lowell, Mass., U. S. A.



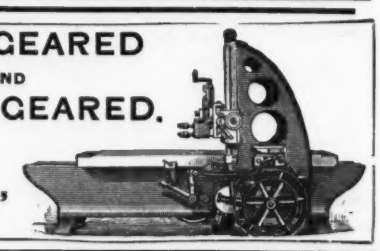
Key-Seating Machines and 20 in. Drills
A SPECIALTY.
SEND FOR LIST OF
New and Second-Hand
Lathes, Planers, Drills, or anything in Machinists' Tools or Supplies.
W. P. DAVIS,
Rochester, N. Y.

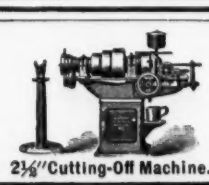
HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.

J. M. ALLEN, President.
Wm. B. Franklin, Vice-President.
F. B. ALLEN, Second Vice-President.
J. B. PIERCE, Secretary & Treasurer.

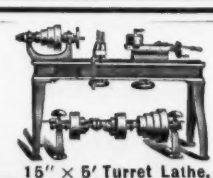
Gear Wheels and Gear Cutting.
Grant's Gear Book for 1892, 15 Cents.
Lexington Gear Works,
Lexington, Mass.

PLANERS SPUR GEARED AND SPIRAL GEARED.
MANUFACTURED BY
The G. A. GRAY CO.,
479 Sycamore St., CINCINNATI, O.

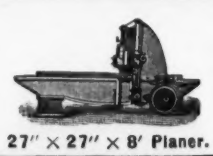




2⅛" Cutting-Off Machine.



15" × 5' Turret Lathe.



27" × 27" × 8' Planer.

THE HENDEY MACHINE CO. MANUFACTURERS OF MACHINE TOOLS. TORRINGTON, CONN.
SEND FOR OUR CATALOGUE
CHAS. CHURCHILL & CO., LTD. AGTS. 21 CROSS ST. FINSBURY LONDON, ENG.

J. M. CARPENTER
PAWTUCKET, R. I.

Manufacturer of TAPS & DIES